WIRE AND WIRE PRODUCTS

JANUARY, 1947

1947

....GREAT WIRE YEAR?

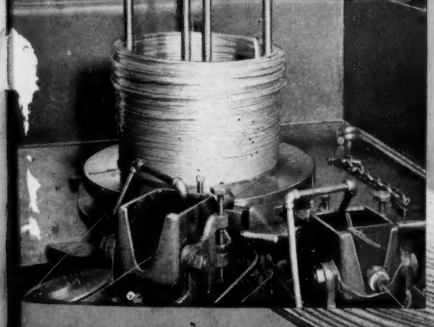
Yes . . . IF! But whatever the situation, there's one thing you can count on for certain: the faithful dependability of Vaughn Wire Drawing Machinery—fast, flexible, efficient—always on the job for better wire production, at lower operating cost! *Let us work with you on your '47 planning.*

The Vaughn

MACHINERY COMPANY
Cuyahoga Falls, Ohio, U.S.A.

COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

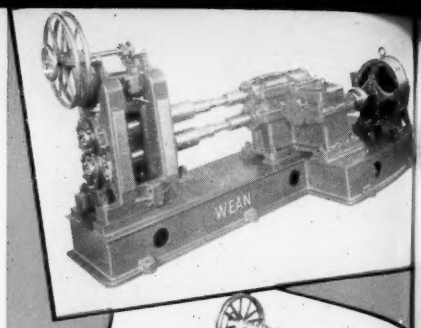
VAUGHN MOTOBLOC

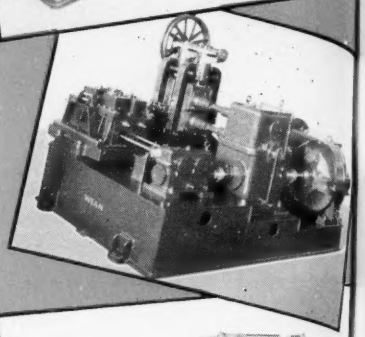


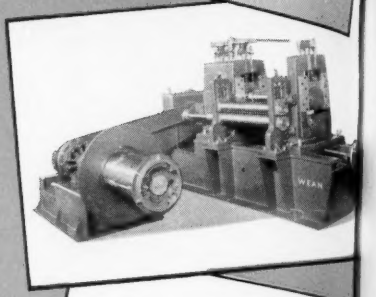
VAUGHN MOTOBLOX

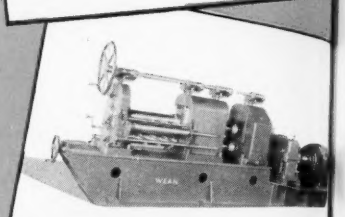
OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

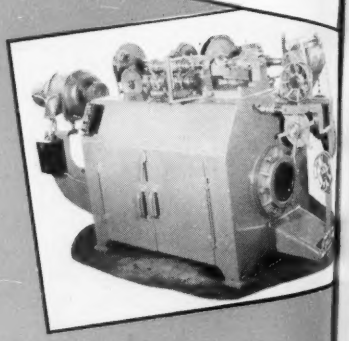
WEAN EQUIPMENT Corporation











THE Wean Equipment Corporation are recognized as specialists in high-efficiency strip and wire mill equipment.

COLD ROLLING MACHINERY
For 36'' Wide Material and Narrower

MILLS • REELS • SLITTERS • LEVELERS

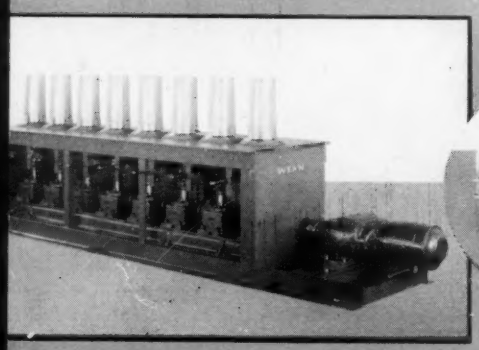
COILERS • EDGERS • SCALE BREAKERS • SHEARS

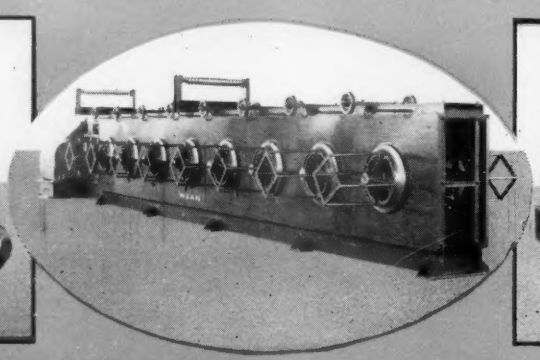
SCRAP BAILERS • CONTINUOUS PICKLING

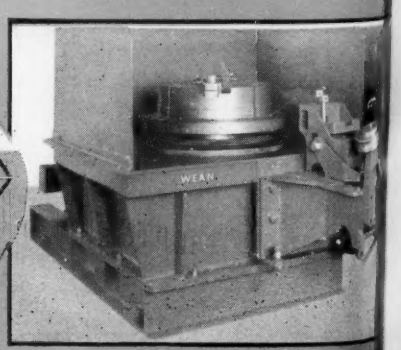
WIRE MILL EQUIPMENT
WIRE DRAWING MACHINES, PATENTING, GALVANIZING AND TINNING TAKE-UP FRAMES, WIRE FLATTENING, SPOOLERS, NAIL GALVANIZING AND BLUEING FIELD FENCE and BARBED WIRE MACHINES

WEAN EQUIPMENT CORPORATION

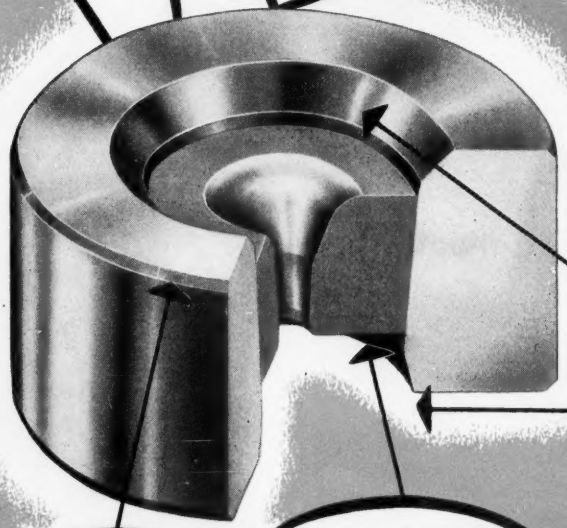
CLEVELAND • OHIO







V-R TAPERED NIB Round Hole Carbide Dies



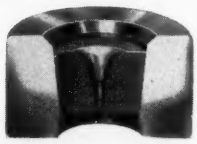
V-R Tantalum Tungsten tapered nib carbide dies for drawing wire, bars and rods give you drawing uniformity over longer periods of sustained wire production. Smoother finishes, more tonnage-per-die and less off-tolerance rejections are some of the results of V-R's "Advance Engineered" tapered nib carbide dies.

TAPERED STEEL CASING
Provides Maximum Stress Absorption and Increased Compressive Strength. No Steel Casing to Cut for Reworking.

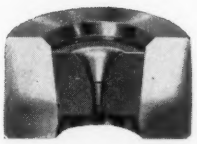
TAPERED CARBIDE NIB
An Exclusive V-R Feature Providing Maximum Nib Strength. Absorbs Excessive Drawing Pressures.

FULL VISIBILITY
Is an Outstanding Result of V-R Tapered Carbide Nib Design. Wide Front and Back Openings Permit Easier Inspection and Reduces Stringing Time.

BLANK DIES are furnished with a reducing angle of 12 degrees and a nib indentation to a depth of 75% of nib height.



ROUGH CORED DIES are furnished with a through hole not smaller than .015 and of standard shape.

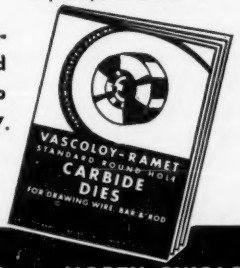


ROUGH DRILLED DIES are held to a minus tolerance to allow for finish.

FINISHED DIES are ready for use. Lapped and polished the dies are finished to your specifications.

For smooth wire production performance call your nearest Vascoloy-Ramet Field Engineer—the man that knows the solutions to your wire drawing problems.

SEND TODAY! for the Vascoloy-Ramet Standard Round Hole Die Catalog. Write to Dept. WW147.



MAKERS OF WORLD'S FINEST VR Carbides

VASCOLOY-RAMET CORP. NORTH CHICAGO ILLINOIS

An affiliate of Fansteel Metallurgical Corporation and Vanadium Alloys Steel Company

DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES

RUST LOCKED OUT

by this tight, uniform zinc coating

Rust doesn't stand a ghost of a chance when it encounters bethanized wire. The chief reason lies in the effectiveness of the uniform bethanized coating.

The bethanized coating is applied by an advanced electrolytic process that builds up uniformly, atom by atom, a defensive armor of 99.9 per cent pure zinc on the steel base. The coating is uniform not only around but along the wire. And the bond between the steel wire and zinc coating is so tight that the two metals may almost be considered as one.

Here's another important advantage of the bethanized coating—its ductility. The bethanized coating is so ductile that it can stand practically any operation used by wire fabricators. It can be bent back upon itself, twisted around its own diameter, even drawn down to fine gauge, without causing the coating to fail.

Because of its uniformity and tight adherence to the steel, the bethanized coating is a natural enemy of corrosion. And whenever greater than normal protection against corrosion is needed, bethanized coatings can be supplied in weights up to three times as heavy as those called for in conventional Type 3 galvanizing.

Why not give bethanized wire a try? Don't choose an easy job for it, though . . . pick a tough one. If you'd like more detailed information, get in touch with the nearest Bethlehem district office, or drop a line to us at Bethlehem, Pa.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

★ **BETHANIZED WIRE** ★

BETHLEHEM STEEL

★

WIRE & WIRE PRODUCTS, Vol. 22. No. 1, January 1947, Publication Office, at Cliff St., New York 7, N. Y. Executive Office, 300 Main St., Stamford, Conn. Published monthly by the Quinn-Brown Publishing Corp., Richard E. Brown, President; R. S. Spengel, Sec. and Treas. Subscription price: U. S., $5.00; Canada, $5.00 per year, 50 cents per copy; Foreign, $7.50 per year. Entered as second class matter, June 14, 1946, at the Post Office, New York, N. Y., under Act of March 3, 1879.

High-Speed fine wire drawing demands the superior quality provided by Alcoa rod.

Alcoa has the know-how and equipment necessary for producing top quality aluminum rod.

Wire mills that draw ALCOA ALUMINUM ROD *start with a* TOP QUALITY *product*

From ore reduction pots through alloying furnaces, the metal going into Alcoa Aluminum rod is checked continually. From the casting of ingots to the finished rod, temperatures and processes are regulated to maintain uniformity. . . . assure top quality.

Whether you draw aluminum wire yourself, buy it from your regular supplier or from Alcoa direct, you benefit because of the higher quality of Alcoa Aluminum rod. ALUMINUM COMPANY OF AMERICA, 1828 Gulf Building, Pittsburgh 19, Pennsylvania.

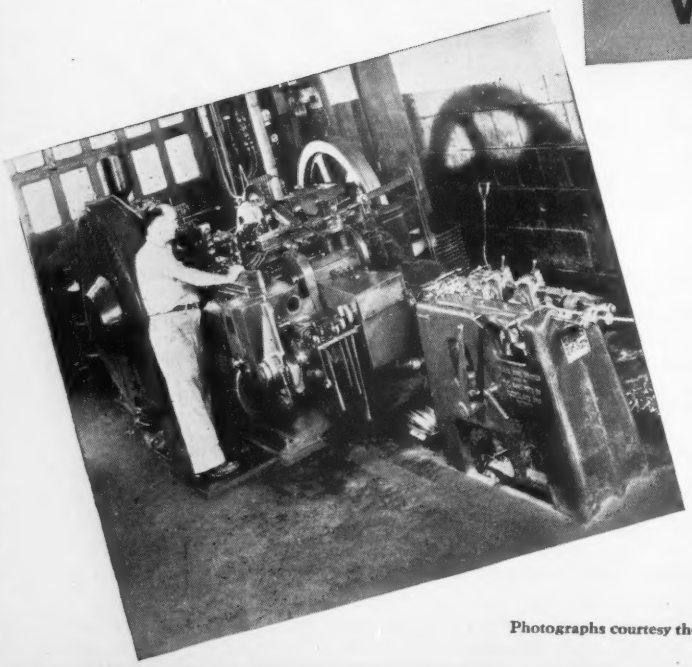
ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM

COLD HEADERS NEED

AJAX-HOGUE

WIRE DRAWERS



THE efficiency and quality of product of Cold Headers is materially stepped-up by the attachment of AJAX-HOGUE wire drawers. The wire, being freshly drawn to unvarying diameter as it is perfectly coated and fed to the header dies, heads easier, more uniformly and with much less wear on the header dies. This improvement in cold heading substantially lowers the cost of production in addition to the saving effected by the use of hot rolled rod instead of cold drawn wire.

Write for Bulletin No. 111.

Photographs courtesy the Chandler Products Corporation.

THE AJAX MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND 17, OHIO

110 S. DEARBORN ST. CHICAGO 3, ILLINOIS

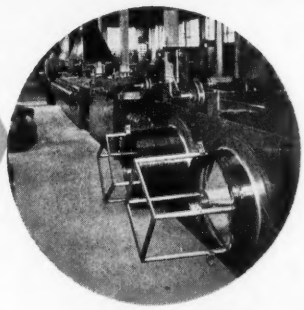
DEWART BUILDING NEW LONDON, CONN.

THE Trauwood PROCESS IS SETTING A NEW "WIREBOUND" TRADITION!!

QUALITY, UNIFORMITY, LOW-COST OPERATION

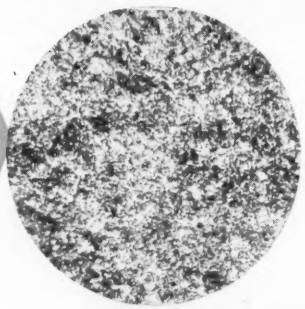
★ The electric resistance heating used in our process is over 90% efficient and results in a uniformly heat treated product plus the ability to duplicate exact heating and quenching cycles from day to day. Positive circulation in the molten metal quench bath insures absolute uniformity of the wire.

FASTER PRODUCTION FULLY AUTOMATIC



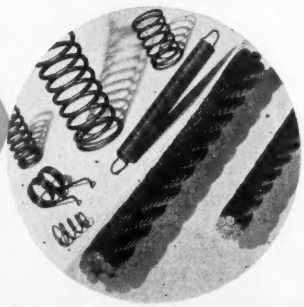
★ The TRAUWOOD process is much faster than ordinary furnace heating due to the very rapid rate of electric resistance heating. The equipment is entirely automatic and is easy to operate. Greater production with a material reduction in pickling and cleaning costs is insured.

BROAD THERMAL RANGE ACCURATE CONTROL



★ The finer grain produced by TRAUWOOD electric resistance hearing develops the maximum physical and fatigue properties in any steel in either patenting, tempering or annealing. The annealing of stainless steel and other alloy wire and strip is readily accomplished since the high quenching temperatures necessary are easily and rapidly attained.

CAN BE DESIGNED FOR ALL SIZES AND TONNAGES



★ The TRAUWOOD process, in addition to doing a better wire heat treating job, is opening new fields of application for the wire industry. The equipment is designed to meet your specific requirements and can be built to handle all sizes in any tonnage required. Full information will be furnished on request.

Patented in U.S.A. and Foreign Countries

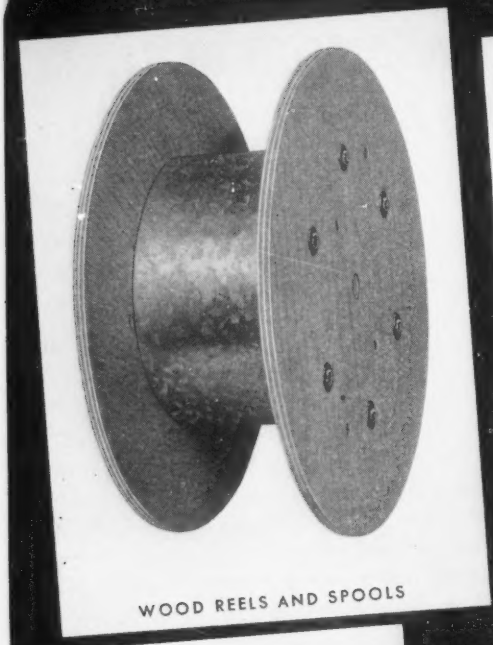
THE TRAUWOOD ENGINEERING COMPANY

WESTERN RESERVE BUILDING . . . . CLEVELAND 13, OHIO

British Representatives:-

JOHN RIGBY & SONS, LTD., LOW MOOR, BRADFORD - YORKS, ENGLAND

for WIRE DRAWING • ANNEALING
HANDLING • SHIPPING



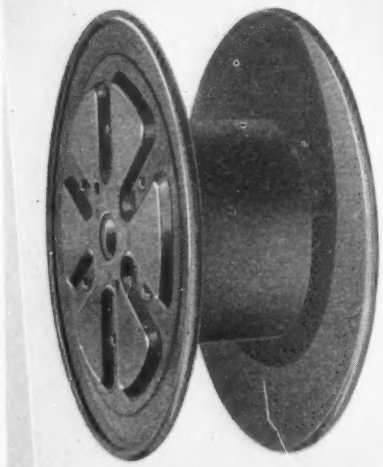
WOOD REELS AND SPOOLS

TRAVERSES

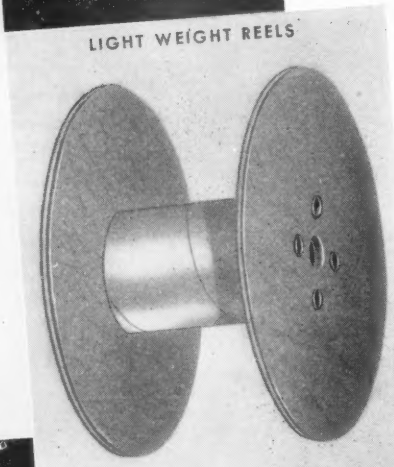
Hubbard
Spools
and Reels

Balanced, ruggedly-built, Hubbard Spools, Reels and Traverses stand up longer . . . decrease replacement costs . . . assure smooth operation at all times. There's a size and type for every requirement. Make Hubbard your dependable source of supply. Write for complete information.

HUBBARD SPOOL COMPANY
1624 Carroll Avenue
Chicago 12, Illinois

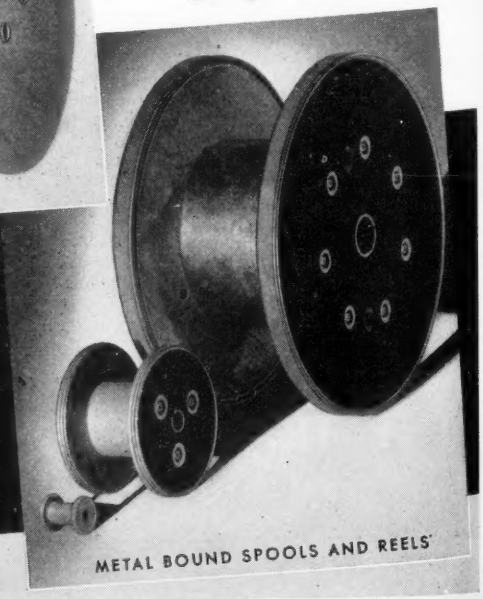


STEEL SPOOLS AND REELS



LIGHT WEIGHT REELS

Hubbard



METAL BOUND SPOOLS AND REELS

ARE YOU SATISFIED....

WITH PRESENT WET WIRE DRAWING RESULTS?

Why not let our Engineers collaborate with you in conducting tests at your convenience for improving your die-life and finish, and increasing production over your present wet wire drawing operation? If you will write us, we will gladly arrange for samples and service. Address —

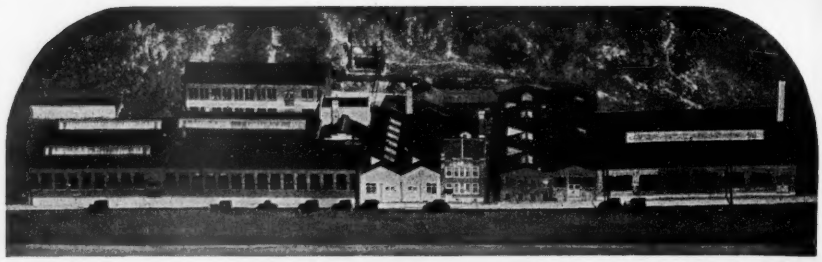
Standardize with Standard

STANDARD INDUSTRIAL COMPOUNDS COMPANY

4600 W. Ferdinand Street, Chicago 44, Ill.

Standardize with Standard

HUDCO



HUDSON WIRE CO. PLANT AT OSSINING, N. Y.

This plant is one of the most up-to-date and completely equipped plants in the world for the production of "HUDCO" fine wires in all metals.

ESTABLISHED IN 1902

HUDCO

WIRES FOR METAL SPRAYING

Pure lead, Lead Alloy, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire. High Conductivity, Electric Wire. Cadmium, Nickel Silver, Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel, Commercial Bronze, Brush Wires, Crimp and Straight, Brass, Steel, Nickel Silver, Copper and Phosphor Bronze.

HUDCO

FINE BARE WIRES

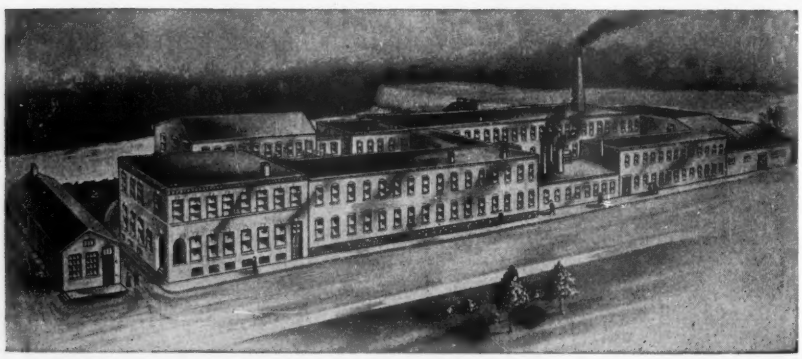
High Brass, Low Brass, Zinz 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper. Cadmium, Nickel Silver, Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification, Metallic Fibre for Packing Purposes, Copper, Bronze, Zinc, Lead and Aluminum.

"HUDCO" specially processed Copper Wire for enamelling purposes is drawn from selected Copper, insuring the maximum conductivity. This is but one example of the use of the most advanced and approved materials and methods in our processing.

BETTER WIRE AT LOWER COST

Send Us Your Specifications and Let Us Quote Prices

HUDSON WIRE COMPANY • OSSINING, N. Y.



Winsted Division of HUDSON WIRE CO. at Winsted, Conn., modern and completely equiped enamelled wire plant for LEAKPROOF ENAMELLED WIRE and all standard and special coverings.

WINCO

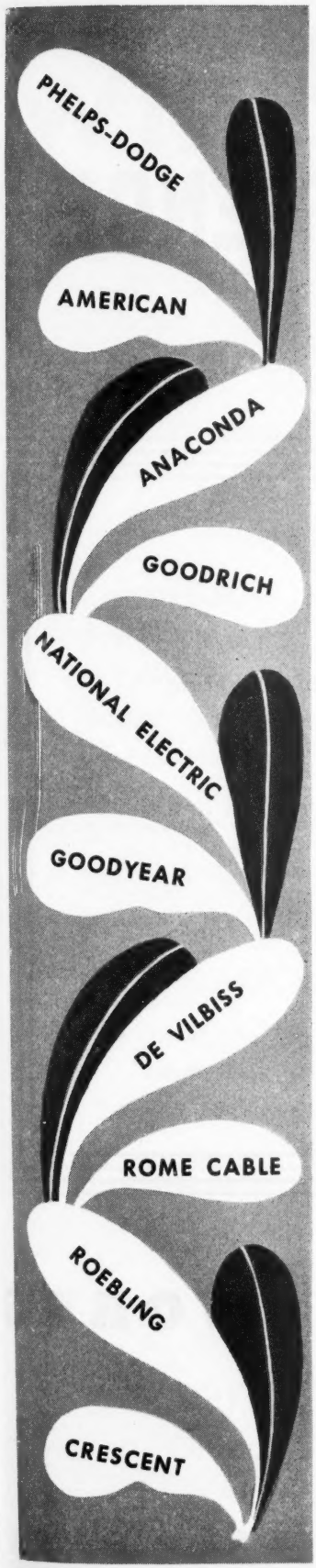
"WINCO" enamelled wire is drawn from special selected copper, assuring perfect enamelling. All wire tested before shipment.

"WINCO" enamelled wire is available in all standard and special coverings made to meet exacting requirements.

Samples of LEAKPROOF and other enamelled wires sent on request

WINSTED DIVISION OF HUDSON WIRE COMPANY

WINSTED, CONN.



Laurels—

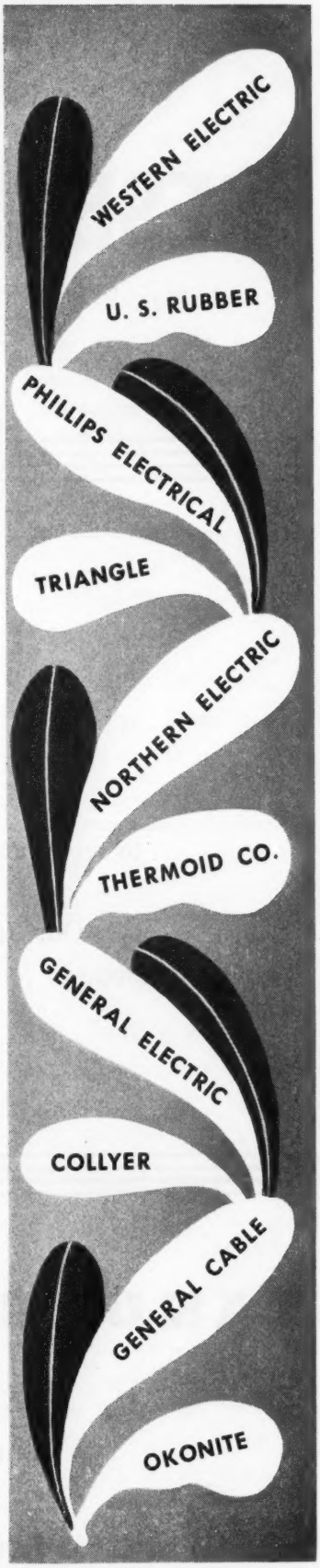
It is a well known fact that if you stop to "rest on your laurels" you fall far behind and lose the race. Through the years since Robertson Hydraulic Machinery won its first laurels, there has been a steady and increasing demand for equipment to produce fine lead encased cable and hose.

Robertson has never "rested on its laurels"—its engineers have constantly improved the quality and performance of Robertson Machinery. They count as "laurels" the many manufacturers who use their equipment, because it gives time-tested performance—efficiency in operation—keeps maintenance costs down. That is why, today, Robertson holds the same first place that it held over half a century ago.

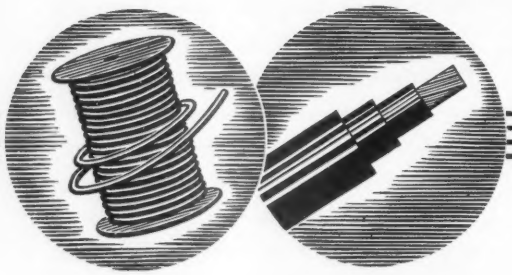
Write for our bulletin describing Robertson Equipment.

Are you receiving "Robertson Reminders," our little book of wit and information? If not, please write to us and we will be glad to put your name on our list.

JOHN Robertson
COMPANY INCORPORATED
125-135 WATER STREET, BROOKLYN 1, NEW YORK
Designers and Builders of all Types of Lead Encasing Machinery
Since 1858



SPECIALIZED RESEARCH EXPERIENCE



In All Types of Insulating Finishes and Impregnating Materials.

All Formulations made to individual specifications and to meet unusual requirements.

Our Hot-melt, Flame-resistant Compounds are non-toxic.

STANDARD VARNISH WORKS

Engineers of Product Finishes

NEW YORK - CHICAGO

SERVING INDUSTRY FOR 75 YEARS

WIRE for Practically All Purposes and Requirements

IRON — STEEL — LOW CARBON — HIGH CARBON

SHAPES

Square - Keystone - Flat
Round - Half Round - Special
Shapes - Straightened
and Cut

Tempered and Untempered

FINISHES

Liquor Finish - Bright
Galvanized - Coppered
Enameled All Colors
Annealed - Tinned
Oil Tempered

FOR

Belt Hooks
Binding - Bonnets
Bookbinders
Brooms - Brushes
Clips - Cotter Pins
Florist - Glass Wire

Grape Tying
Hair Pins
Hooks and Eyes
Link Fabrics
Lock Washers

Mattresses
Pins
Special Springs
Ropes - Stapling
Stone Wire
Tags -- Weaving

* * *

• FLY SCREEN WIRE CLOTH • GALVANIZED HARDWARE CLOTH •

* * *

HIGH CARBON FLAT WIRE TEMPERED AND UNTEMPERED

Gutter Broom
Square

Curtain Spring
Snap Spring
Bobby Pin — Flat & Half-round

Lock Spring
Fish Tape

LOW CARBON

Cotter Pin

Box Stitching

Bookbinders

Highest Quality and Service Guaranteed

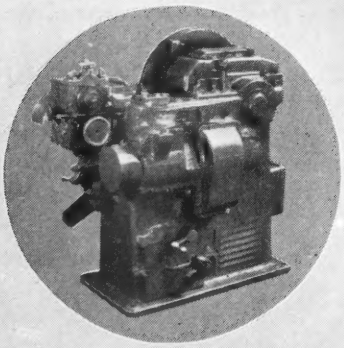
* * *

ESTABLISHED 1905

The Seneca Wire & Mfg. Company

Fostoria, Ohio

Representatives and Warehouses in principal cities



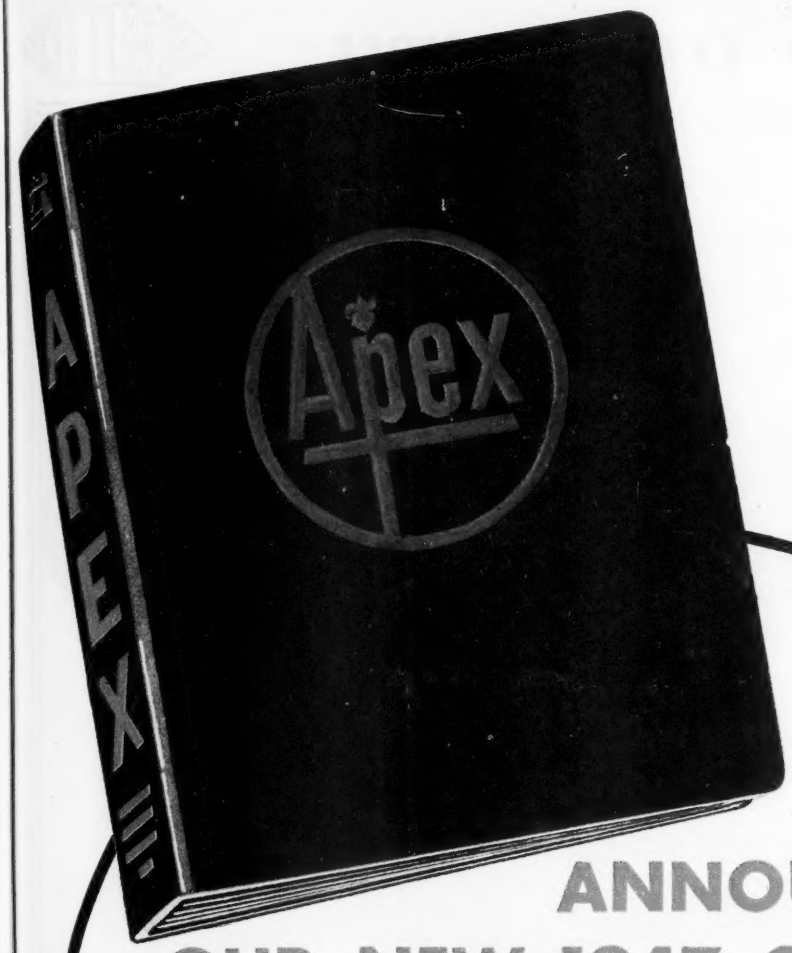
THE COMPANY WHICH IT KEEPS

Although introduced only a few years ago, today's list of National Cold Header users is a "Who's Who" of the bolt and rivet industry.

If you are not among those who are "cashing in" on it's wide possibilities, let us present you with the facts.

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO

New York Detroit Chicago



ANNOUNCING OUR NEW 1947 CATALOG

Fifty-six pages crammed with ideas and facts on the latest developments of Apex Wire Drawing Compounds and allied cleaning and drawing compounds.

To receive a copy of our catalog with its helpful Ready Reference Conversion, Hardness Comparison and other useful tables, simply request it on your company letterhead.

Actual size of catalog is 9″ x 12″ loose leaf so sheets can be added later as we send them to you.

Apex Alkali Products Co.

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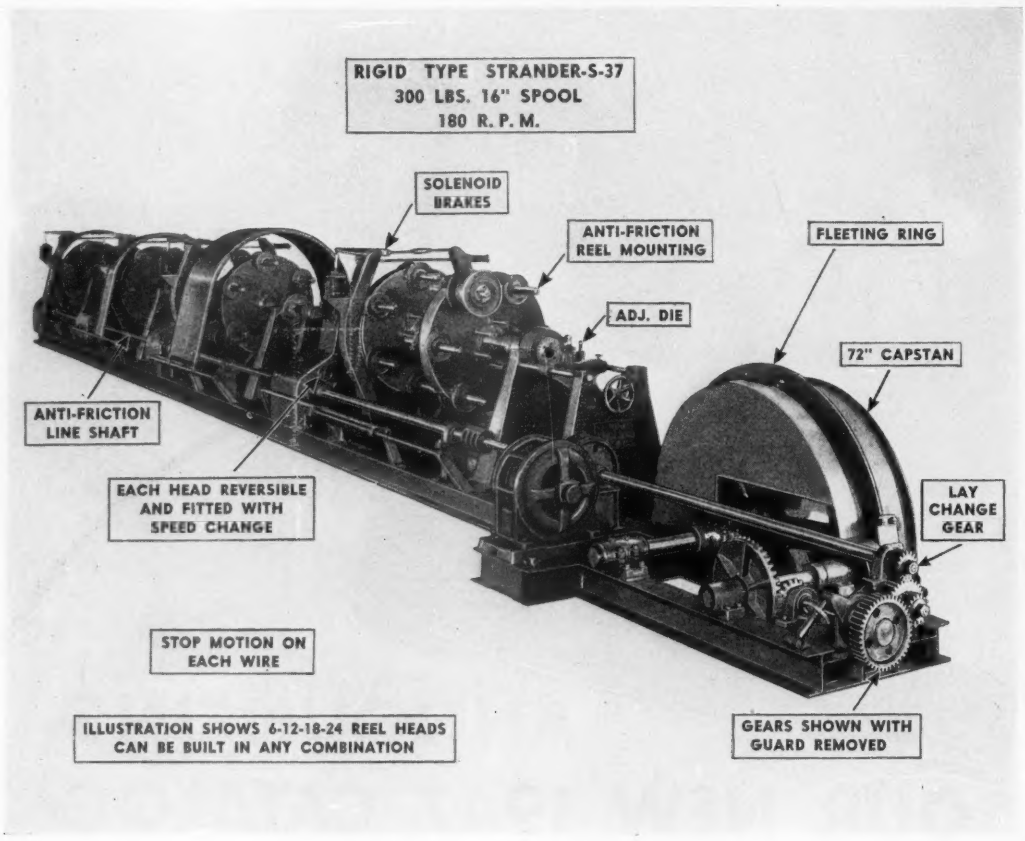
RIGID TYPE STRANDER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Each spool section is equipped with —

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Large diameter wire guide sheaves
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Built in sizes up to 500 lb. spool.

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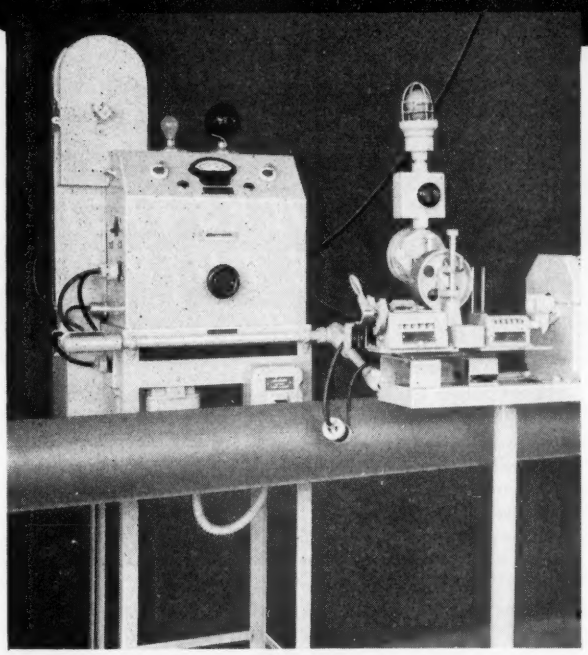

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4 Gives lamp and buzzer signal, as end of a predetermined length is reached on each reel.

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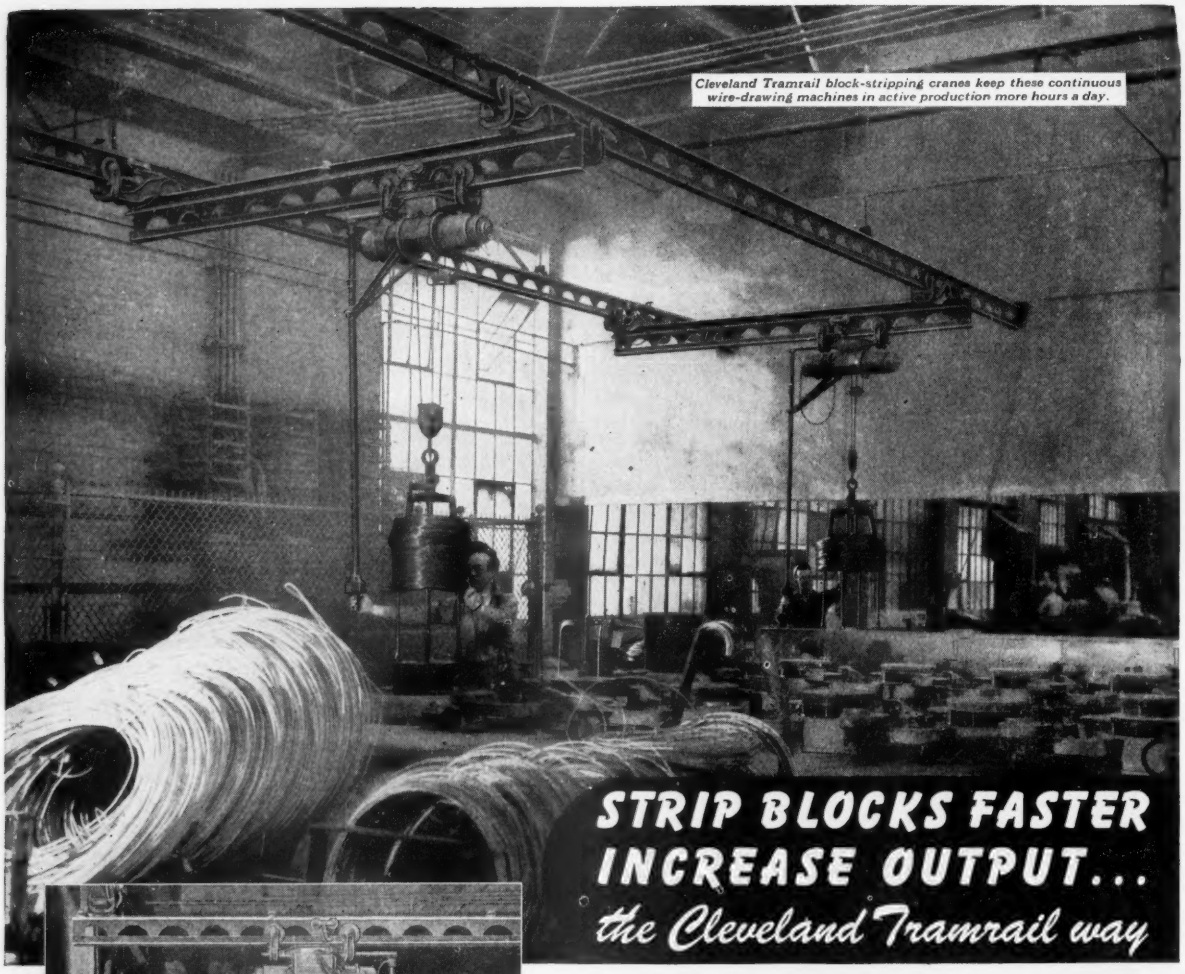
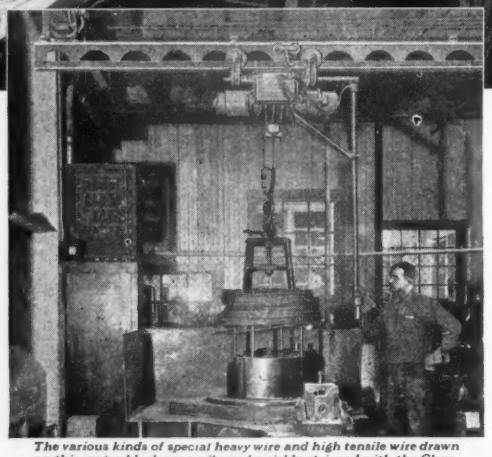


Cleveland Tramrail block-stripping cranes keep these continuous wire-drawing machines in active production more hours a day.

STRIP BLOCKS FASTER INCREASE OUTPUT... *the Cleveland Tramrail way*



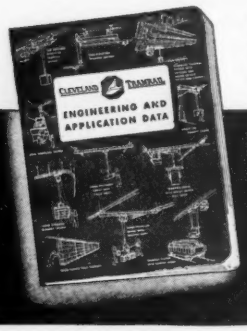
The various kinds of special heavy wire and high tensile wire drawn on this motor block are easily and quickly stripped with the Cleveland Tramrail crane.

Many mills in the United States and Canada have installations of Cleveland Tramrail block-stripping cranes and carriers. They are stripping draw blocks faster and keeping them in operation more hours a day, thus stepping up output.

Smooth rolling Cleveland Tramrail equipment has been especially designed for this service. It allows a man to take care of more blocks and draw heavier bundles. Older experienced men can usually keep pace with younger fellows when this equipment is provided.

The equipment consists of a hand-propelled crane or carrier with an electric hoist. The crane or carrier is easily pushed on its ball-bearing wheels by means of the rigid arm attached to the carrier. Push buttons, conveniently located in the handle at the lower end of the arm, control the hoist.

Cleveland Tramrail overhead materials handling equipment has been developed to serve every department in rod and wire mills.



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R. H. MILLER CO., Inc.

HOMER, New York

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A New Year Greeting

Is extended to all our subscribers and advertisers.

Throughout the year we endeavor to serve you through our publication and in the many other ways, as opportunity offers, where we are privileged to extend the helping hand.

Without your interest and cooperation our problems would be magnified many times over. We take this occasion to thank our friends throughout the Wire Industry for those contributions of time and effort that have helped to make WIRE AND WIRE PRODUCTS an instrument of constructive and practical assistance to the field.

We are well aware that the New Year, with all its silver lined clouds, is fraught with some big unanswered questions, the proper solutions to which will help us to spend a year, which looking back upon, we will find has been good and profitable.

We sincerely wish for you all a happy and successful New Year and that our big industrial problems will be wisely composed to the benefit of everyone.

Richard E. Brown, President.

WIRE and WIRE PRODUCTS

The Hand on the Doorknob . . .

TURNS A PIECE OF *SHAPED WIRE*

The use of wire drawn to special shapes is a fast-growing industrial practice. More and more manufacturers are learning how Continental shaped wire made to fit a particular application can cut costs and improve their products.

Continental wire is made in standard and special shapes in a great variety of sizes, tempers, and finishes. There is a Continental wire to enhance the "sales appeal" of the items you manufacture. Your products may have one or more parts that can be "shape-engineered" from wire to do their job better and more economically. Write today for a copy of Continental's handy booklet with helpful wire information for manufacturers.

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GENERAL OFFICES • KOKOMO, INDIANA

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"KNOW-HOW"... at your disposal

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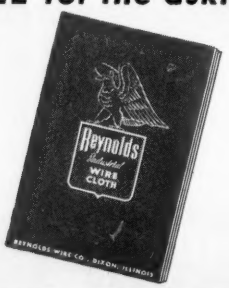

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... the high-frequency cable that makes **RADAR** *possible*

is insulated with

Du Pont POLYTHENE

CUT-BACK SECTION of a modern twin coaxial cable for use in direction-finding equipment at ultra-high frequencies (400 to 10,000 megacycles). JAN-C-17 designation RG-23/U; made by Anaconda Wire & Cable Co. The insulation, about 140-150 mils thick, is Du Pont polythene.

Radar and associated electronic developments, born in stress of war, have important peacetime uses immediately ahead. Ships and planes which, without radar, might be hopelessly lost in foul weather or fog, may now soon be located ...come safely to harbor or airport... thanks to one or several of the four main types of radar.

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Other properties of Du Pont polythene: outstanding chemical inertness, light weight (specific gravity 0.92), low moisture permeability, flexibility in thin sections, rigidity in thick. For complete data sheet, write to E. I. du Pont de Nemours & Co. (Inc.), Plastics Dept., Room **141**, Arlington, N. J.

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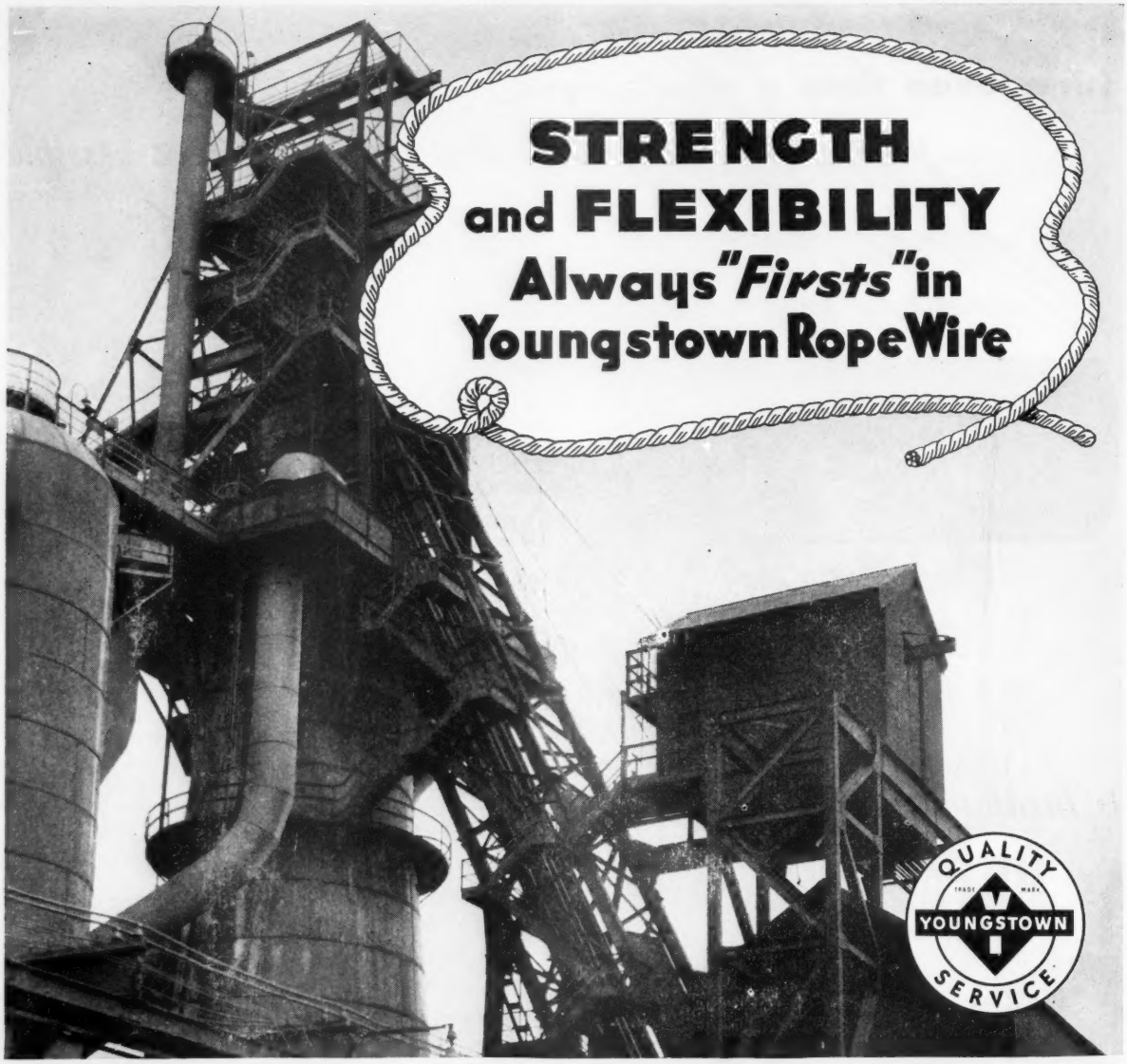

For Blast Furnace Skip Hoists

ON a few thousand feet of wire rope hangs the entire output of America's pig iron and steel. There are fewer than three hundred blast furnaces, each one dependent on a small skip or bucket hoist, drawn by wire rope, to lift raw materials and fuel to the top of the stack for charging.

It is easy to visualize how seriously wire rope breaks, kinks or other difficulties can interfere with iron and steel production. The wire rope must be strong, flexible and tough. IT HAS TO BE GOOD.

Wire rope can be only as good as the wire from which it is woven. That's the reason to specify and use Yolectro High Carbon Rope Wire for critical service.

Yolectro High Carbon Rope Wire is produced from the finest steel, refined, rolled and drawn to exacting specifications. Its chemical composition and metallurgical characteristics are carefully designed and controlled to provide the right balance of strength, flexibility, toughness and corrosion resistance, to meet the most severe service requirements. As with all Youngstown wire mill products, Yolectro High Carbon Rope Wire has built its reputation on quality.

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9 WAYS to Improve WIRE DRAWING

FOR more than three years a new coating for wire drawing has been used by many mills instead of lime. The results obtained are outlined in the data below.

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on the basis of the results it has obtained, warrants a most careful investigation on your part. Here is what it offers you:

1. **Better Finish** on any wire, particularly on stock drawn for metallic coating and other special finishes, and on bright, rope, welding and tire bead wires.
2. **Reduced Rejects**—rejects caused by scratching and off-size wire are virtually eliminated.
3. **Better Rust-Proofing** than was possible before Magnus #267 was introduced.
4. **Reduced Lubrication Costs** due to the fact that #267 calls for lean lubrication. In many cases savings amount to as much as 50%.
5. **No Hydrogen Embrittlement**—which is eliminated right in the coating solution.
6. **Longer Die Life** on any drawing operation, but most striking on continuous, high speed operations.
7. **No Liming or Baking** eliminates the trouble, expense and mess of the liming operation and subsequent baking.
8. **Cleaner Machines and Surroundings** which result from the elimination of liming. Greatly improved working conditions.
9. **Reduced Overall Drawing Costs** as a result of savings in liming and baking costs and the improvements in product and operations. Ultimate cost per ton of wire drawn is much less than when lime is used in spite of the much higher initial cost of Metal Coat #267.

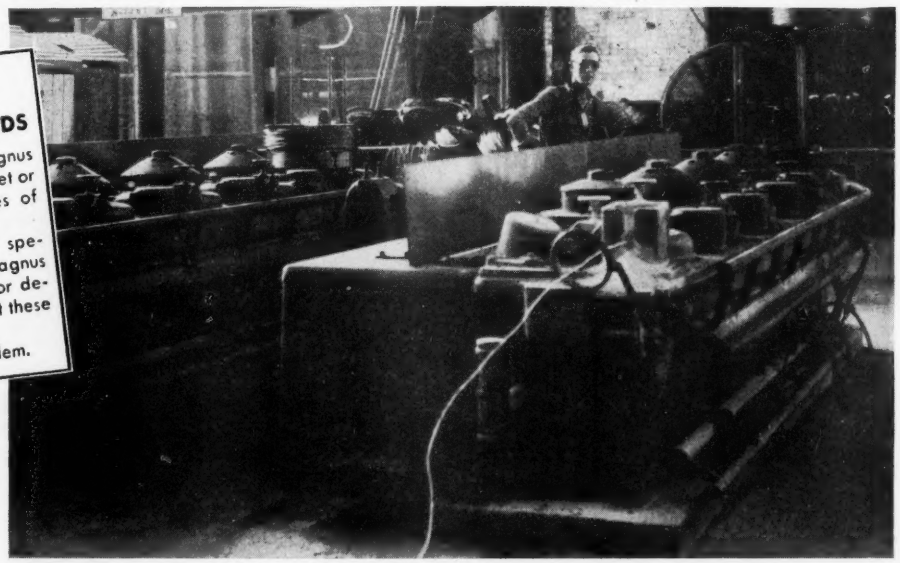
LOOK INTO #267

HEADQUARTERS *for* DRAWING COMPOUNDS

There's a complete line of Magnus Drawing Lubricants for dry, wet or grease drawing of all types of wire at any speed.

Where requirements are special, the facilities of the Magnus Laboratory are available for developing compounds to meet these requirements.

We welcome your problem.



Magnus Wire Drawing Compounds

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Service Representatives in Principal Cities

IN CANADA — MAGNUS CHEMICALS, LTD., 4040 RUE MASSON, MONTREAL 36, QUE.

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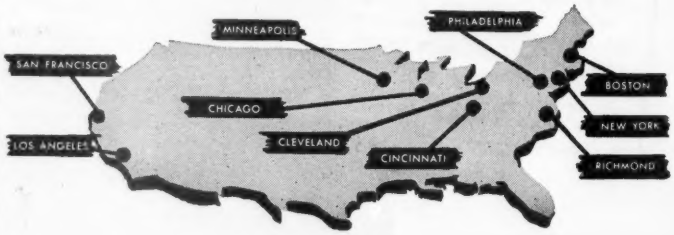
At this price you can afford to stockpile even against next year's requirements—for these savings will pay storage and interest charges over a long, long time.

Order today from any War Assets Regional Office. But for quickest delivery and less risk of disappointment, order from these offices which have the stock on hand:



types available:

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Also fair quantities of stainless steel tubing at about 50% discount from net mill prices f.o.b. location.

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The material offered is subject to withdrawal prior to shipment.

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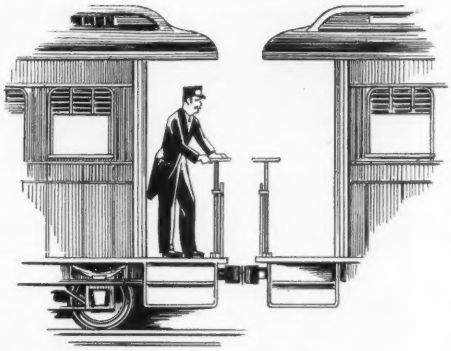
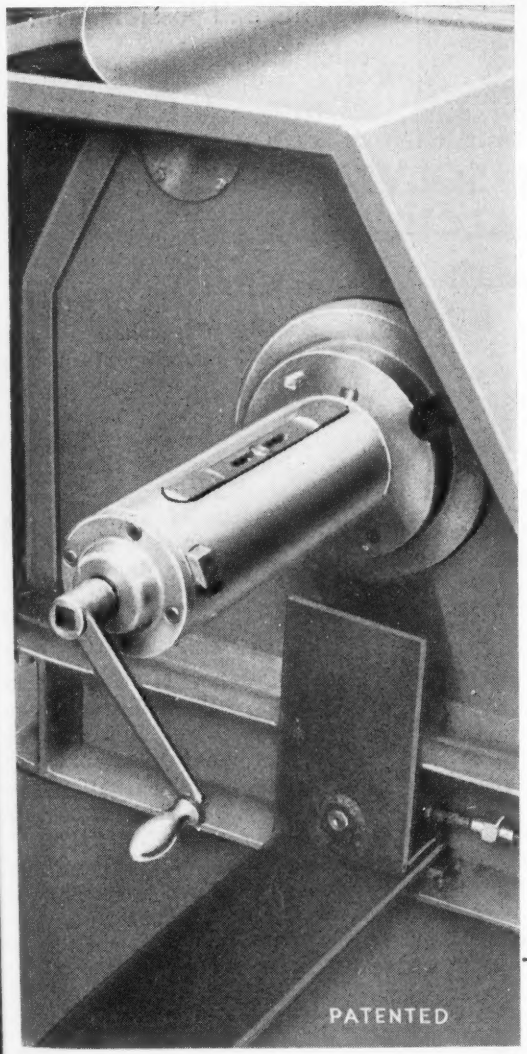
THE COURAGE TO BREAK WITH TRADITION





THE invention of the air brake made possible, the controlled speed of our modern railways. Like all pioneers, Westinghouse had the courage to break with tradition.

In like manner, Syncro engineers are inculcated with the pioneering spirit. Never content to rest on their laurels, they constantly strive to improve Syncro products — for that way lies progress.

Such developments as the Syncro Expanding Take-Up Arbor, which greatly increases safety, makes possible the use of reels having out-of-round bores and facilitates reel handling, are the result of Syncro engineering — which never hesitates to break with tradition when such action results in better, safer, more economical design.

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SYNCRO MACHINE COMPANY

EXECUTIVE OFFICES AND GENERAL WORKS — 611 SAYRE AVENUE, PERTH AMBOY, N. J.

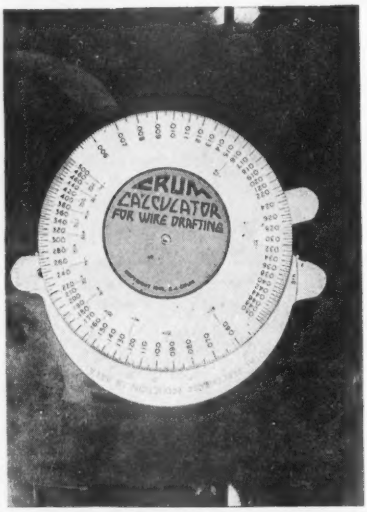
Machinery for the Wire Industry

SYNCRO

The Crum Calculator for Wire Drafting

Provides answers simply and accurately for a given mathematical wire drafting problem. One setting shows number of holes, percentage of draft per hole, total reduction in area and intermediate die sizes to be used. Universality: Because of the circular scale there are neither upper nor lower limits on the diameters that the calculator can be used for.

* * *



Simple to operate; compact enough to carry in vest pocket; can be used for Metric as well as English systems; all diameters given in decimals. A handy and time-saving device that will eliminate time-wasting and possible errors in calculations.

* * *

EXAMPLES OF PROBLEMS SOLVED QUICKLY BY USE OF THE CALCULATOR

PROBLEM No. 1

DETERMINE the reduction of area in drawing ¼-inch diameter rod to .120 inch wire.

PROBLEM No. 2

SUPPOSE that in Example 1 the tensile strength of the stock is such that the drawing process produces a tensile strength of 100,000 pounds per square inch in the .120 inch wire. To develop the same tensile strength in an .080 inch diameter wire, what stock size is required when the tensile strength of the stock is assumed to be the same as that in Example 1.

PROBLEM No. 3

IN the drafting of .0625 inch diameter wire to .025 inch, no single draft must exceed 21 per cent. Determine the minimum number of holes for this job.

* * *

THE Crum calculator is designed especially for wire drawing jobs involving eight or fewer drafts. Problems involving a greater number of drafts can be solved, however, with extra manipulation. For instance, if it is desired to set up a multi-draft machine to draw .0095 inch diameter wire from .0625 inch stock in sixteen drafts, the intermediate die sizes can be determined by the calculator.

PROBLEM No. 4

A CERTAIN five-block continuous wire drawing machine has a capacity permitting a draft of 33 per cent per hole on low carbon wire. For economic reasons it is desired to find the largest stock size that can be used when finishing .0455 inch diameter wire on this machine.

* * *

PROBLEM No. 5

A continuous machine is to be set up to draw .0375 inch tire bead wire six holes from .122 inch diameter stock. All drafts are to be equal in percentage reduction of area. Determine "a" the intermediate die diameters; "b" the per cent reduction of area per hole "c" the total per cent reduction of area from start to finish.

PROBLEM No. 6

THE diameter of the finishing block of a double-deck wire drawing machine is twenty-four inches; the diameter of the first block, seventeen inches. The operator wishes to finish .142 inch diameter wire from No. 5 rod and therefore must determine (a) the minimum draft for the finished die, (b) the minimum first die size, (c) and the first die size when a slippage of ten per cent is allowed.

* * *

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The Wire Outlook

As we enter upon the New Year, the question uppermost in every mind is: Do we face a new and better era?

Monopolistic labor trends have been checked and although the big leaders will fight desperately to maintain their power, we believe that developments from Election Day to the present have laid a foundation for better and sounder relationships with labor, management's co-partner in industry. Their leaders have so overplayed their hands and so disregarded the rights of the other elements of our complex society, that union members themselves have suffered, but should nevertheless be direct beneficiaries of the new era that we have a right to anticipate.

What the labor czars have overlooked, or chosen to ignore, is that we all are part of one big entity. The unbalancing of one element harms not only other segments of society, but the one that strives for some uneconomic advantage. We have said before and restate again that the many proposed laws that will undoubtedly issue from the new Congress will not be to labor's disadvantage, although it is to be hoped that they will curb the personal ambitions of some so-called "leaders."

Not to be overlooked in all of this is that unstinted production must follow if labor's future is to be a sound and improving one. Only through a prospering of the entire industrial machine can any one part of it hope for stability and betterment. Required reading, proving that a leader can be a man of vision and integrity, is a letter published in the December Reader's Digest entitled "Class Struggle Isn't the Answer". The turn from a sellers' to a buyers' market is under way. Buyers are becoming increasingly "choosy" and many are putting off major purchases until better products and lower prices prevail. New wage demands at this time can only result in further price increases and every such advance narrows the market for the products of labors' hands. This is a day, in labor's own interests, for work of such character that unit costs may be lowered and quality increased.

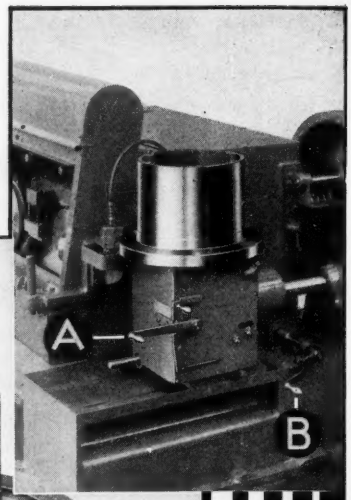
While the labor angle has been emphasized because labor has been in the saddle, it is necessary to go on record to the effect that management also has its responsibilities and must not fail to demonstrate in this crisis that it understands its obligations and that it can re-assume them under a free economy. Competition, the free operation of the law of supply and demand, a voluntary distribution to labor of whatever it is entitled to by virtue of its contribution to increased earnings, plus an enlightened attitude in the exercise of power, must be the order of the day. If capital and management fail to live up to the stewardship now passing back to them, then indeed will the system of free enterprise be in jeopardy in our fair land.

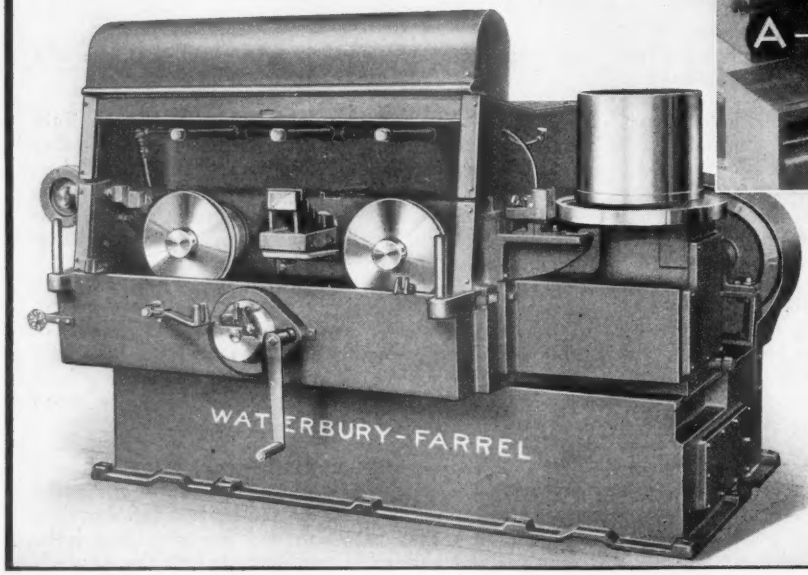
The sword of Damocles still hangs over our heads. It is our considered opinion that in spite of the "rooking" given the American people by certain high Administration politicians in the past dozen years and by those racketeers who played with them and throve at public expense, America will fulfil her destiny with Fate to prove again that free-enterprise is best for all. We shall continue to have "sores in our side" — racketeers, profiteers and revolutionists — as reminders that thus each citizen has a personal responsibility in acheiving industrial peace and success.

We believe in the destiny of our Union. As we begin this momentous New Year, we extend to all our readers the hope and the expectation that 1947 is ushering in for them and for all the dawn of an era that will bring rich satisfaction and peace through the years ahead.

—from the Editor's Desk

WIRE DRAWING MACHINES





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by WATERBURY-FARREL

WITH WIRE BLOCKS WHICH *rotate in either direction*

Upright Cone Continuous Machines with provision for quickly changing the rotation and position of block.

Two conveniently located removable handles do the trick in jig time—

A — changes direction of rotation
B — shifts position of block . . .

The machines are available with blocks of various diameters or with spooling devices. Our wire drawing machinery is described in Catalog W.

● WIRE AND ROD MACHINERY ● COLD HEADING MACHINERY, ETC. ●

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FOUNDRY & MACHINE COMPANY
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WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 22 JANUARY, 1947 No. 1

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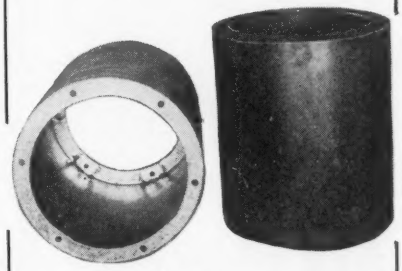

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

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GALVANIZED STEEL WIRE

by FRED. M. CRAPO, President

Indiana Steel & Wire Company, Muncie, Ind.

The Mordica Memorial Lecture

1946

This lecture is an interesting historical review and evaluation of the present state of the art of galvanizing wire. It was presented at the annual Wire Association Convention held at Buffalo, New York, October 21st - 24th, 1946

PRESIDENT Hussey, Members of The Wire Association and Guests:

I greatly appreciate the honor of having been chosen by the Board of Directors of The Wire Association to present the Eighth Mordica Memorial Lecture, and the opportunity of paying tribute in this manner to John Mordica whose untiring efforts and vision meant so much in the organization and early success of The Wire Association.

* * *

THE application of a zinc coating to ferrous metal to protect it from corrosion had its inception over two hundred years ago, before the middle of the Eighteenth Century. About 1830, the term "galvanizing" began to be used to describe such zinc coating and this term originated by reason of the galvanic action of zinc. Since that early date, zinc has held first rank among metals for protective coatings.

* * *

IT is estimated that at least one-third of all steel wire is galvanized. Zinc coatings on steel wire are applied almost universally by either immersion in molten zinc, the hot-dip process, or by electrolytic deposition, the cold process. Other methods for protecting steel wire with zinc have been proposed, however, consideration will be given to only those methods which are of commercial importance.

FREDERICK M. CRAPO

President, Indiana Steel & Wire Company, Muncie, Indiana. Inventor of Crapo Galvanizing Process. Responsible for development of steel conductors which bear his name. Graduated 1919 at Rose Polytechnic Institute as Bachelor of Science. Took post-graduate work at Massachusetts Institute of Technology. Joined the Indiana Steel & Wire Company in 1923 as chief engineer and, in 1927, became vice-president in charge of manufacture. Succeeded in the presidency in 1940 upon the death of the company's founder, the late Alva L. Kitselman. Member of The Wire Association, American Institute of Electrical Engineers, American Society for Testing Materials, American Society of Metals, American Welding Society, and American Standards Association.

* * *

* * *

Hot-Dip Galvanizing — Early History

NO attempt will be made to trace accurately the history of galvanizing; instead, it is intended to outline events considered of importance in its development and to clarify some points regarding its history.

* * *

THE hot-dip method of zinc coating is the oldest and most used, and so far as it has been possible to determine, originated in France. In 1741, **Melouin,** a French chemist, reported experiments in which zinc coatings were produced by dipping in molten zinc (1, 2, 3, 4). The similar process of tinning copper and iron was previously known and Melouin used zinc in place of tin.

* * *

IN MEMORIAM

JOHN MORDICA

1873 - 1937

IN 1787, there was published in London a very comprehensive chemical and metallurgical treatise entitled "Chemical Essays," which was written by **R. Watson,** an English Bishop and Professor of Divinity of the University of Cambridge (5). Bishop Watson related that of late years at Rouen, France, a method had been introduced of applying a coat of zinc upon hammered iron sauce pans which had been made very bright so that not a black speck could be seen, rubbed with a solution of sal ammoniac, and then dipped into an iron pot full of melted zinc.

* * *

IN 1836, **M. Sorel** of Paris, France, was granted a French patent and in 1837, a corresponding United States patent (6) which discloses different methods of utilizing zinc in various forms as a coating material for preserving iron and steel articles from oxidation or rusting by the previously known galvanic action produced by the zinc. One of five methods described was that of coating the articles to be protected with molten zinc and complete details are given which embody certain fundamental operations which are still inherent in all hot-dip processes. It is interesting to note that M. Sorel also states in his patent: "Wire may be coated by passing it through the melted zinc as it is wound off from one drum or reel onto another."

* * *

IN 1837, **Henry William Craufurd** of England was granted a British patent (7) essentially identical to Sorel's French patent and although Craufurd often has been given the credit for the disclosures made in his British patent, the specification refers to the invention as being a communication from a foreigner residing abroad; that foreigner was undoubtedly M. Sorel.

* * *

IN 1854, a French patent relating to a new mechanical process of galvanizing iron and steel wires was granted to Boucher and Muller of Paris, France (8). The equivalent British patent was granted to William Johnson in 1855, however, this British patent stated that it was a communication from two foreigners, **A. D. E. Boucher and Adrien Muller.** (9). This is an apparatus and process patent and discloses continuous hot-dip coating of a number of steel wires simultaneously with zinc, tin or alloys. This patent specification shows a drawing (Fig. 1) which is of interest because of its resemblance to galvanizing units in use today. The specification of the patent gives instructions for paying out the several wires from reels, then passing the wire through a solution of "double chloride of zinc and ammonia," or "hydro-chloric acid diluted with water," then through two steel gauge plates which remove any superabundant amount of metal. The coated wires are instantly cooled by jets of cold water to impart a brilliancy not hitherto obtained. The wires are then dried and wound onto drums. It is noted that annealing prior to cleaning was not contemplated.

* * *

A British patent of 1859 granted to **Emile Alexandre Cuche** of France describes an improvement in smoothing the zinc-coating by subjecting the wire just after it emerges from the molten zinc to jets of cold or warm air or gas and in certain cases "heated to a variable temperature, even to a state of incandescence, always having the object in view to augment the adhesion of the zinc." (10).

* * *

IN 1860, **George Bedson** of Manchester, England, applied for a British patent for "Improvement in Annealing, Cleaning, and Galvanizing, or Coating Wire and Sheets or Strips of Metal with Metals." (11). Bedson's improvement was making a continuous operation of annealing, cleaning and galvanizing by providing a tube furnace so that the strands of wire first pass through the furnace, then into muriatic acid and subsequently through the zinc. (Fig. 2). In 1893, **Joseph Phillips Bedson** stated that before his father's invention in 1860, wire was annealed in pots and then cleaned before it was taken to reels from which it was unwound in a wet state. Wire treated in this manner gave trouble due to embrittlement from acid in the wet coils, or due to partial drying of the surface, which caused bare spots. (12).

Hot-Dip Wire Galvanizing in the United States

BEDSON'S process of continuous annealing and galvanizing of wire was introduced into the United States about 1864 by **Ichabod Washburn,** the founder of Washburn and Moen Company, especially for galvanizing telegraph wire which was in great demand at that time. Mr. Washburn made a trip to England about 1860 (13), and met Mr. Bedson. Later they corresponded about wire galvanizing, rod mills, etc. (14). Arrangements were made whereby Washburn would use Bedson's process and Washburn agreed to help Bedson with his application for a U. S. patent which was granted February 17, 1863. (15).

* * *

IN October, 1864, Mr. Bedson wrote Mr. Washburn that he was sending all the sketches, iron work, and take-up blocks for the galvanizing unit. He was also sending a man from England to erect and start the unit. In December, 1864, Bedson wrote that Washburn should not cover the whole bath with sand, but should cover the bath with muriate of zinc, except for sand at the exit end, as a "wipe." In July, 1865, the unit was evidently started, for Bedson wrote that he regretted to learn that Washburn was still pot annealing the wire. Bedson urged that the tube-type annealing furnace be installed, since he said it would give wire with 12½% higher tensile and 12½ to 15% more ductility.

* * *

WIRE manufacturing in the United States was only a minor industry until the introduction of barbed wire and woven-wire fence after which it became a leading industry. Barbed wire was invented in the United States and its production was started about 1874 at DeKalb, Illinois, by **Joseph F. Glidden** with the assistance of **I. L. Ellwood,** (16). The rapid expansion and development of American agriculture created a large demand for barbed wire and later for woven-wire fence.

* * *

MUCH of the early barbed wire had fairly heavy zinc coatings

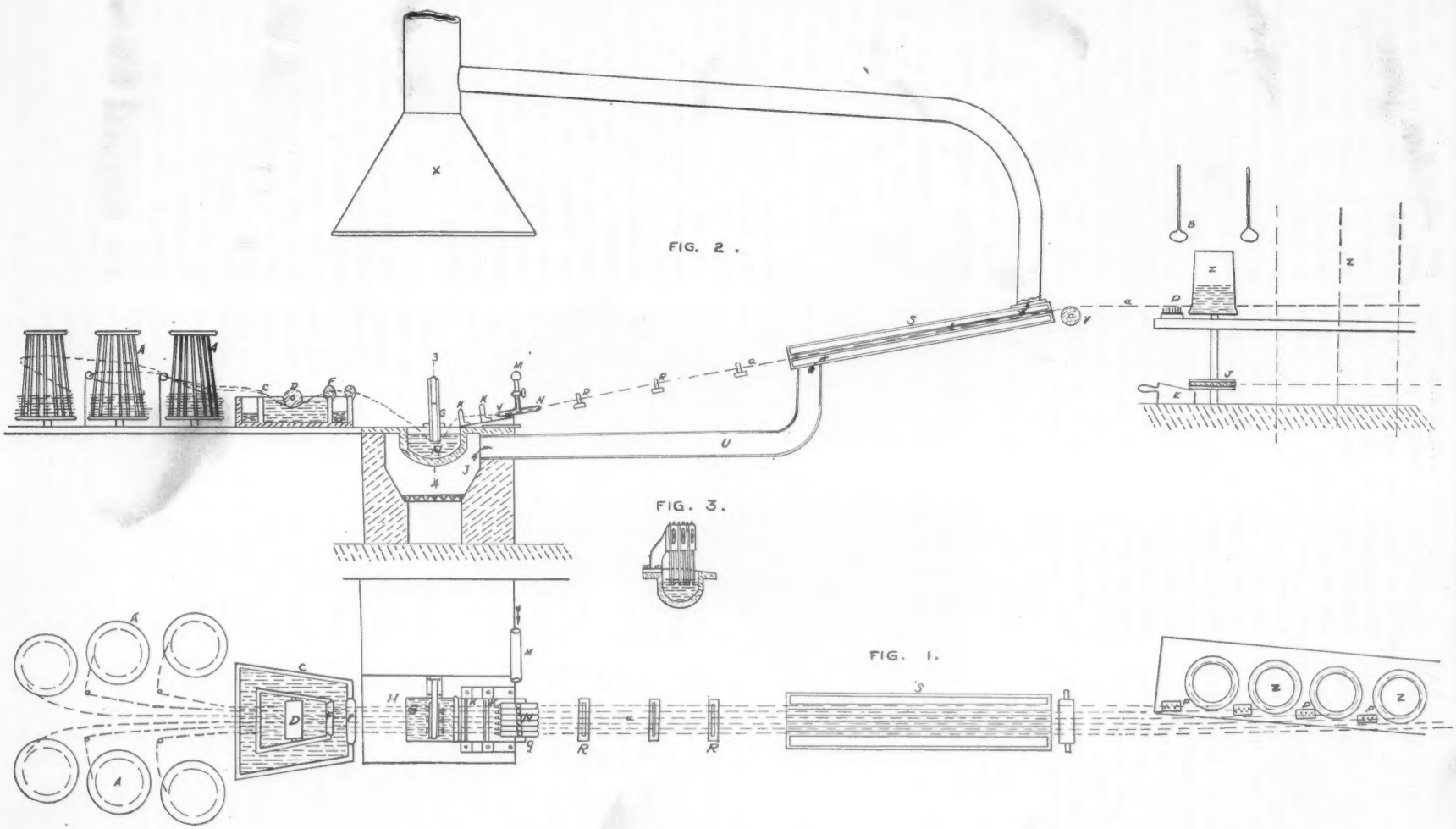

Figure 1. Wire Galvanizing Apparatus as shown by British Patent No. 484 of 1855. The parts are designated as follows: "A", reel from which wire is unwound; "C", acid or flux tank; "H", bath of melted zinc; "K", steel gauge or draw plate for wiping the wire; "N", tube with current of cold water to prevent oxidation; "S", drying tube; "P", combs or straighteners; and "Z", take-up block.

FIG. 1.

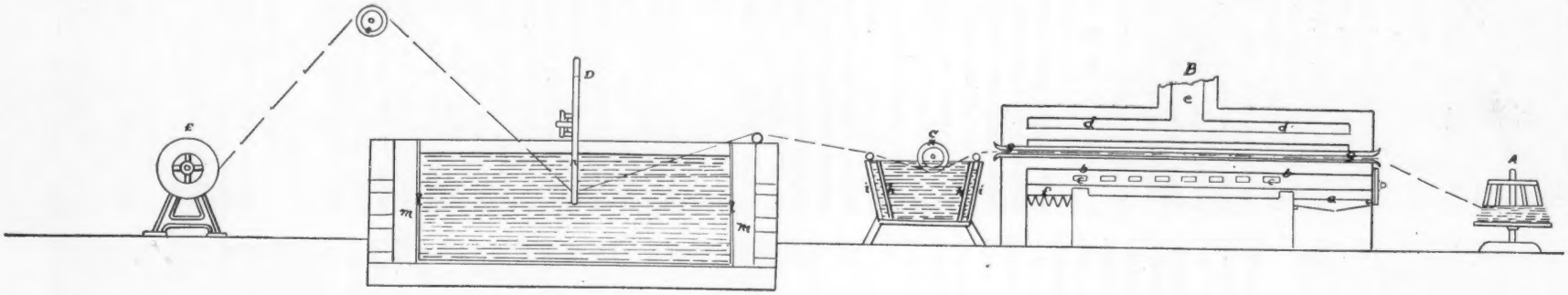

FIG. 2.

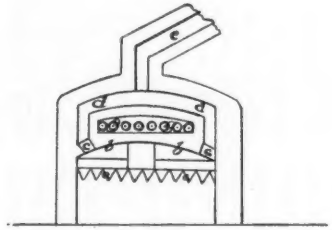

Figure 2. Wire Galvanizing Apparatus as Shown by Bedson's British Patent No. 2144 of 1860. The parts are designated as follows: "A," reel from which wire is unwound; "B," annealing furnace; "C," muriatic acid cleaning bath; "D," galvanizing bath of molten zinc; and "E," take-up block.

produced with a moist sand bed from three to six inches deep, floating on the molten zinc for a so-called "wipe." The wires were chilled as they passed upwards out of the zinc and through the sand. The coatings so produced were relatively heavy, but quite rough and uneven, and often sand particles were embedded in them.

* * *

BY 1900, in the United States the use of a sand wipe had been replaced by a charcoal bed or wipe although in England and in Continental Europe, sand wipes were extensively used until 1928 when the charcoal wipe was introduced from the United States. Actually the bed of charcoal has little or no wiping action. It does provide a non-oxidizing atmosphere over the surface of the molten zinc, which keeps it clean where the wire emerges. The charcoal serves to promote a clean smooth surface of the coating.

* * *

THE large demand for galvanized wire for the manufacture of barbed wire and fence stimulated competition and started a search for means of lowering manufacturing costs. This resulted in the development of the "tight-wiped" wire, made by using asbestos pads to smooth and wipe the molten zinc from the wire just after it emerged from the zinc. This permitted wire to be passed through the molten zinc much faster and also used much less zinc.

* * *

THE **"tight-wiped"** wire soon became known as **"single galvanized"** and the **charcoal-wiped** wire, as **"double-galvanized."** The latter implies that the wire is passed twice through the molten zinc, which is not true; however, the weight of the coating is usually approximately double that of the tight-wiped wire and this no doubt had something to do with the origin of the term.

* * *

IN the period 1880 to 1890, there are quite a number of patents on wire galvanizing and at least half of these cover various methods and apparatus for tight-wiping wire in order to reduce the amount of zinc. **Matteson's** patent, issued in 1890, (17) covered a lever-type wipe, using asbestos pads, which is essentially the same as used today.

* * *

THE fence wire galvanizers finally made zinc coatings so thin by the tight wiping process that the farmers complained about the short life of the fencing. (18, 19). The reaction to these complaints was to produce wire with a little heavier zinc coating at as low cost as possible. One way by which heavier tight-wiped coatings were produced was to increase the length of the spelter pan and run the wire slower so that more zinc-iron alloy would form.

* * *

ANOTHER result of the demand for the heavier galvanized coatings on fence wire was the development of the **"Galvannealing"** process on which the first of a series of patents (20, 21) was granted to **Joseph L. Herman** of Peoria, Illinois, in 1922. The **"Galvannealing"** process is similar to regular wire-galvanizing except that after the wire leaves the molten zinc, it enters a muffle furnace where for a few seconds the coating is subjected to a temperature of approximately 1,250°F. (22). Heating the zinc-coated wire in this muffle tends to smooth the coating. This process results in a weight of coating that is between the weight of coating of a tight-wiped and a charcoal-wiped wire. With this process wire is galvanized at speeds comparable to those used for tight-wiped wire. The heat-treatment of **"Galvannealed"** coatings causes the iron content of the coating to be higher than the iron content of the charcoal-wiped coating.

* * *

ANOTHER similar zinc-coating process, also primarily developed for galvanizing fence wire is the **"Flame-Sealed"** process, on which U. S. Patents were granted in 1933 and 1934 to **Julian L. Schueler** of Kokomo, Indiana. (23, 24). Wire galvanized by the **"Flame-Sealed"** process is annealed, cleaned, fluxed and passed into the molten zinc similar to regular galvanizing practice. However, as the wire leaves the zinc bath it passes through a "coating regulator" which is essentially a metal bar with a V-notch for each wire to pass through and a pivoted blade with an inverted V-notch, which comes down over the top of the wire. After passing through the "coating regulator", the wire goes through a series of flames which smooth the coating. The weight of coating is usually between that of tight-wiped and charcoal-wiped wire. Speed of galvanizing is comparable to that for tight-wiped wire. An improved control of coating weight is claimed.

* * *

THE so-called **"Crapo"** process was primarily developed for improving the adhesion and ductility of the charcoal-wiped zinc coating on wire for special purposes, such as telephone, telegraph, power conductors and similar wires which require Class A coatings; that is, coatings on the order of 0.80 to 1.00 oz. per square foot of surface for wires of No. 12 to 8 BWG.

* * *

IN the development of this process it was observed that various base metals reacted differently when immersed in molten zinc. Ferrous wires of different chemical analysis when coated side by side by the ordinary galvanizing process resulted in coatings of different weights and with different characteristics. That is to say, if wires of the same diameter, one each of ingot iron, mild rimmed steel, mild rephosphorized steel, medium carbon steel, and of high carbon killed steel are galvanized on a charcoal wipe frame, at the same time under identical conditions, the resulting coatings are different in microstructure, in weight and have widely different degrees of adherence. Research to determine the effect of surface treatments led to the discovery that the treatment of the wire in certain molten salts, in practice, salts in which a cyanide is the active element, or in certain gases, as ammonia to nitrogenize prior to entering the molten zinc would produce such a chemical change and permeative addition in the surface of the wire that there resulted the property of tenacious

adhesion to the subsequently applied zinc coating. This tight adhesion of the coating was the outstanding improvement obtained by this new process, and made it possible to subject the coated wire to severe bending and deformation, as for example by wrapping it around its own diameter, without flaking or peeling of the coating.

* * *

A fourth wire galvanizing process developed in the United States is the **"Herman"** process (25, 26), named after its inventor, **Joseph L. Herman,** also patentee of the **"Galvannealing"** process. This process is essentially the same as ordinary wire galvanizing except that where the wire comes out of the molten zinc it passes through a **"Herman Galvanizing Machine"** (27). The **"Herman machine"** is an auxiliary spelter tank with a nozzle-shaped slot across the bottom, which is partly submerged in the molten zinc of the main kettle. A revolving impeller pumps the molten zinc out of the auxiliary tank into the main kettle, which causes molten zinc to flow upwards from the main kettle through the nozzle-shaped slot in the bottom of the auxiliary tank. The wires are passed upwards through this same slot into a non-oxidizing gas-filled chamber which forms the top of the auxiliary tank, and thence upwards through a slot and a water quench. The weight of zinc coating produced by the Herman process can be varied within limits, but in general, is of the order of that for charcoal-wiped wire. Speed of galvanizing is slightly greater than that for charcoal-wiped wire and this, along with the water quench tends to minimize the zinc-iron alloy in the coating.

* * *

IN general, with, the exception of mechanically-wiped wires, the weights of coatings that can be produced by the hot-dip galvanizing methods described are limited by the thickness of the molten zinc film which adheres to the zinc-iron alloy on the wire as it emerges from the molten zinc bath. Factors tending to produce heavier coatings have certain limitations. With increased speed it is difficult to control the uniformity of the thickness of the coating. Higher zinc temperatures and greater length of immersion in the zinc bath increases the formation of zinc-iron alloy in the coating and this makes for brittle coatings.

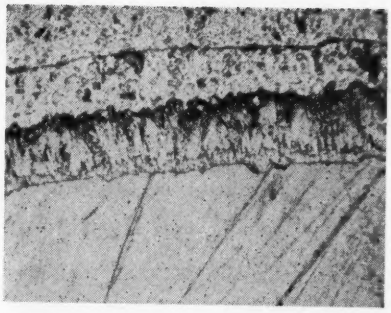

Fig. 3 Galvanized Coating on Charcoal-Wiped Steel Wire (X 300).

* * *

* * *

SOME special methods have been patented by **Elder** (28) and **Harris** (29) which involve passing the wire through molten zinc at such temperature and speed as to freeze a sheath of zinc on the wire. These processes are somewhat sensitive and their commercial use has been limited.

* * *

The Formation of Hot-dip Zinc Coatings

WHEN a piece of iron or steel is properly cleaned, fluxed and immersed in molten zinc, the surface of the piece is "wetted" by the zinc and zinc-iron alloy forms on the surface. This zinc-iron alloy continues to form as long as the piece is immersed in the molten zinc. The rate at which this alloying action takes place is a function of time and temperature. It is also influenced by the analysis and the structure of the piece of ferrous metal.

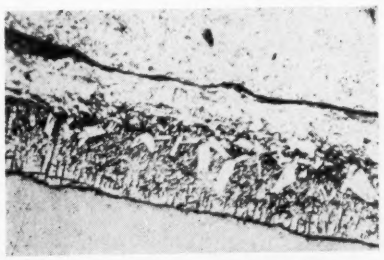

Fig. 4 Experimental Zinc Coating Showing Definite Crystals of Fe Zn_7. (X270)

* * *

* * *

ZINC-IRON alloy forms at a temperature even below the melting point of zinc, and thus iron continues to diffuse into a zinc coating and form zinc-iron alloy even after the coated piece has been removed from the molten zinc and until the temperature of the coated metal is below about 500° F., which is approximately 286°F. below the melting point of zinc.

* * *

THUS, the subsequent heat treatment of coatings as in the **"Galvannealing"** and **"Flame-Sealed"** processes tends to increase the iron content of those coatings.

* * *

IN ordinary hot-dip wire galvanizing, the wire is in the molten zinc from a few seconds to approximately half a minute and the thickness of the zinc-iron alloy which forms is usually less than one-thousandth of an inch. As the wire emerges from molten zinc, the surface of which is clean, there will be an outer film of zinc over the zinc-iron alloy, which will be of the same as the zinc in the molten zinc bath. This explains the relatively pure zinc outer layer of hot-dip coating and the underlying zinc-iron alloy next to the steel wire base. This is shown in Fig. 3, which is a photomicrograph of a cross-section of a charcoal-wiped galvanized wire.

* * *

THE bottom part of the photomicrograph, (Fig. 3) is the steel wire itself: next there is a band of zinc-iron alloy crystals which have "grown out" of the iron wire base; next is the outer layer of relatively pure zinc. Then comes a zinc matrix in which the wire was held for polishing purposes.

* * *

ZINC and iron form definite intermetallic compounds such as Fe Zn_7 (10.9 per cent iron) and Fe Zn_8 (21.83 per cent iron). (30). The compound Fe Zn_7 forms rhomboidal crystals which can be seen occasionally in the zinc-iron alloy

of hot-dip galvanized coatings as is shown in Figure 4. This is a photomicrograph of an experimentally-produced coating.

* * *

TO produce this experimental sample (Fig. 4) a zinc-coated wire which had been heated after coating to produce a higher than normal iron content in the coating, was passed a second time into a molten zinc bath and up through a charcoal wipe. The Fe Zn_7 crystals can be seen clearly in the zinc-iron alloy of this zinc coating. The second immersion in molten zinc has caused the Fe Zn_7 to separate in definite crystal forms.

* * *

THERE are three schools of thought as to the composition of zinc-iron alloy in hot-dip zinc coatings: One, that the zinc-iron alloy exists in layers with a single intermetallic compound in each layer. The second, that the zinc and iron are in solid solution and that the seeming existence of layers is due to variation in crystal size, with smaller crystals near the ferrous surface and larger crystals away from it. The third, that the zinc-iron intermetallic compounds are in solid solution in zinc. (31, 32, 33, 34, 35, 36).

* * *

IT is generally agreed that the iron content of the zinc-iron alloy in the hot-dip zinc coatings becomes progressively higher toward the ferrous surface.

* * *

THE building up or "growing" of the hard zinc-iron alloy on steel surfaces is shown to a greatly exaggerated degree in Figs. 5 and 6. These show cross sections of No. 12 BWG wires of different steel compositions, which were immersed in the same molten zinc bath at a temperature of about 870° F. for 40 hours.

* * *

IN each figure (Fig. 5 and 6) the round steel wire is easily identified at the center. Around each wire is a growth of zinc-iron alloy, having the appearance of a rosette. A close examination of each of these rosettes will show that there is a difference between them. The

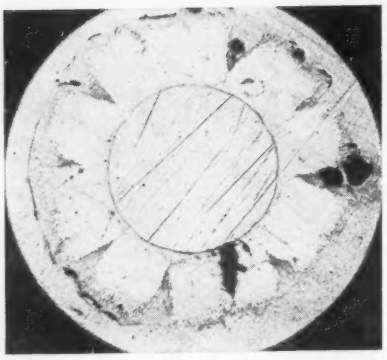

Fig. 5 Zinc iron alloy formation on a low carbon rimmed steel wire which had been immersed in molten zinc for 40 hours. (X15)

zinc-iron alloy on the rimmed steel (Fig. 5) seemed to grow more nearly straight out from the wire with less lateral growth so that there are a number of rather deep V-notches. The zinc-iron alloy rosette on the killed steel (Fig. 6) does not have as many or as deep V-notches. This indicates that the steel base or some constituent of the steel caused a difference in the formation of the zinc-iron alloy.

* * *

OTHER examples of long-time immersion in molten zinc, which indicate that zinc-iron alloys are affected by the composition of the steel base are shown in Figs. 7, 8 and 9.

* * *

THE lower part of the photomicrograph, in each case, (Fig. 7, 8 and 9) is the iron wire base. Above this is a band of zinc-iron alloy very high in iron and very brittle. This band in Fig. 9, which is on wire having a surface containing relatively high carbon and

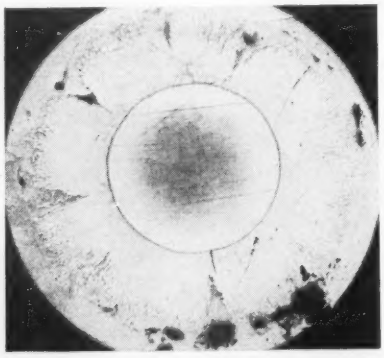

Fig. 6 Zinc-iron alloy formation on a 0.50 carbon killed steel wire which had been immersed in molten zinc for 40 hours. (X 15)

nitrogen, has some unusual lines which are probably due to the presence of zinc-iron-nitride alloy. Fig. 10 shows higher magnification of these unusual lines.

* * *

ATTENTION is called to the columnar crystals above the zinc-iron alloy band on the killed steel, shown in Fig. 8, as contrasted to the more granular appearance of the zinc-iron alloy in the corresponding region on the rimmed steels, as shown in Figs. 7 and 9.

* * *

SINCE these long-time immersions in molten zinc indicate that zinc-iron alloys are different when there are variations in the composition of the steel base, it would be expected that the zinc-iron alloys which form during normal hot-dip galvanizing would likewise be different for different compositions of the steel base. Moreover, it seems reasonable to conclude that the different zinc-iron alloys would have somewhat different physical properties. It is suggested that these differences in zinc-iron alloys might be at least partly responsible for the greater adherence of hot-dip zinc coatings on some types of steel wire as compared to others.

* * *

THE precise nature of the mechanism by which zinc coatings adhere to the surface of the base metal is most difficult to determine. So far, a satisfactory examination of the intermolecular or inter-granular structure at the boundary zone has not been possible. However, it seems plausible to theorize that there is a differential etching by the molten zinc of the surface of the ferrous base in such manner that there is a "keying-in" or "interlocking" of the coating with the ferrous surface.

* * *

ADHERENT zinc coatings can be produced on wires of killed steels having a normal amount of silicon. Also, adherent zinc coatings can be produced on steel wires whose surfaces contain relatively small amounts of nitrogen.

* * *

REPHOSPHORIZED basic open-hearth steels containing about

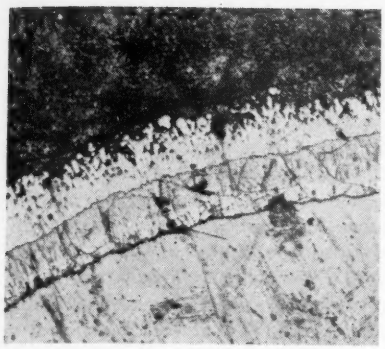

Fig. 7 (X125). Zinc-iron alloy formed on low carbon rimmed steel wire which was immersed one hour in molten zinc at 860°F.

.05 to .08% of phosphorus have been used to obtain more adherent hot-dip zinc coatings. The addition of this small amount of phosphorus to the steel base greatly increases the rate of formation of zinc-iron alloy. (37). On tight-wiped wire this is desirable, at least from the production standpoint of the thicker tight-wiped coatings, that is, coatings on the order of 0.50 ounces of zinc per square foot of surface.

* * *

THE smoothness of the ferrous surface has some effect on the zinc-iron alloy formation and on the adherence of the zinc coating. Fig. 11 shows a charcoal-wiped zinc coating on a 12 gauge low-carbon rimmed steel wire which was made very smooth by final polishing with 00 metallographic type polishing paper. Fig. 12 is the charcoal-wiped coating on an adjacent length of the same wire which had been roughened with coarse abrasive paper.

* * *

IT will be noted that the zinc-iron alloy is much more uniform in thickness on the smoother surfaced wire Fig. 11. It also is noted that on the rougher surfaced wire (Fig. 12) the zinc-iron alloy seems to "grow" much faster from the high points of the steel surface. When these wires were wrapped on their own diameter, the coating on the smooth surfaced wire peeled while the coating on the rough surfaced wire only checked badly, but did not come off in long strip-like pieces as did the coating from the smoother wire.

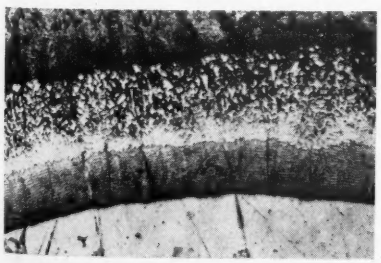

Fig. 9 (X125). Zinc-iron alloy formed by immersing in molten zinc for one hour at 860°F., a low carbon rimmed steel wire, the surface of which had been treated to have a relatively high nitrogen and carbon content.

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THE properties of hot-dip zinc coatings are affected also by additions to or impurities in the molten zinc bath, and several investigators have reported on this. (38, 39). Present day practice is not to use any additions to the molten zinc for galvanizing wire.

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Electro-Galvanizing Early History

IN 1803, in England, a **Mr. Cruickshank** reported some experiments in which he found that compounds of several metals, including zinc, were reduced by the electric force of the galvanic battery (40). During the next 70 years numerous investigators in continental Europe, England and in the United States reported new discoveries on the electro-deposition of metals and a number of patents were granted (41, 42, 43, 44, 45).

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DURING this period, however, limited commercial application of electro-deposition was made because a good, low-cost source of electric current was not available. The early investigators used galvanic or voltaic cells, and even thermopiles to supply electric current.

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IN 1871, **Gramme** produced the first useful electro-magnetic machine for continuous electric currents. It was some time later, however, until electric generators were available which were reliable sources of electric current for electro-deposition.

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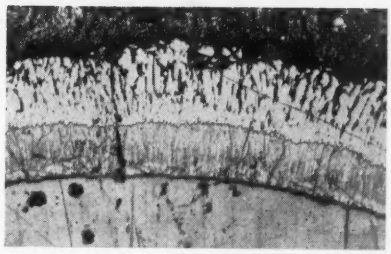

Fig. 8 (X125). Zinc-iron alloy formed on high carbon killed steel wire which was immersed one hour in molten zinc at 860°F.

THE early record of wire electroplating equipment is contained in several patents: **Fox** in 1879, **Smith** in 1881 and **Rawson** in 1896, (46, 47, 48). These patents primarily provided novel means for obtaining a long immersion of the wire in the plating solution. This was necessary because of the low rate of zinc deposition by reason of the use of the very low current densities which were typical of the plating processes then known.

* * *

IN 1892, **Cowper-Coles** in England became a strong advocate of electro-galvanizing. He succeeded in getting the British Admiralty to specify that all boiler tubes for Naval ships be "electro-zinced", not only to protect the tubes from corrosion during the time of assembly, but also because the "electro-zincing" made posible the de-

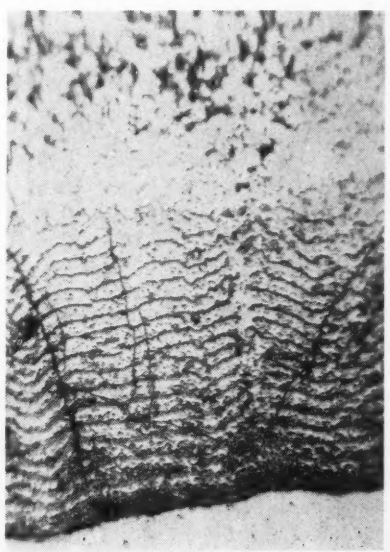

Fig. 10. Same as Fig. 9 except magnified 520 times.

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tection of flaws. (49). About 1895, the **English Post Office** tested and reported favorably on some wires with zinc coatings of 1.26 ounces per square foot which had been coated by **Cowper-Coles.** (50, 51). Apparently these tests were made on laboratory samples and none of this zinc-coated wire was made commercially, probably because of limitations due to slow rates of zinc deposition.

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Electro-Galvanizing of Wire in Germany

IN Germany the firm of **G. Langbein and Company,** which later became the **Langbein Pfanhauser Werke,** developed a wire electro-galvanizing process and, before World War I, had made 35 small installations scattered over continental Europe, (52, 53). The earlier installations were for very thin coatings on the order of 0.10 to 0.15 ounce zinc per square foot, but the later ones were for coatings up to 0.30 ounce zinc per square foot. After World War I, **Langbein Pfanhauser Werke** continued the development of wire electro-galvanizing and by 1930 had installed 15 more plants, mostly small, some of which were designed to apply coatings up to 1.0 ounce zinc per square foot. In 1937, **Langbein Pfanhauser** installed a wire galvanizing plant in Canada.

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THE Langbein-Pfanhauser process utilizes a long, shallow plating cell. The wires are pulled through the cell and are kept immersed a few inches below the surface of the electrolyte. The electrolyte is a low acid or almost neutral solution of zinc sulphate with certain additions, the composition of which is secret. Special rotating cathode contactors (54) carry electric current to the wires. Cast or rolled zinc anodes are used and these are usually placed between the wires. The process operates at current densities of approximately 400 to 500 amperes per square foot.

* * *

IN the operation of the **Langbein-Pfanhauser** process, the wire after being annealed and pickled, is given an anodic cleaning treatment before passing into the plating cell. The patent (55) for this anodic cleaning states that the bath is sulphuric acid with a concentration less than 250 grams per liter and with the current density on the wire higher than 20 amperes per sq. dcm. (185.8 amperes per sq. ft.). This anodic treatment was developed to give better adhesion of the heavier zinc coatings and was apparently unnecessary for the thinner coatings.

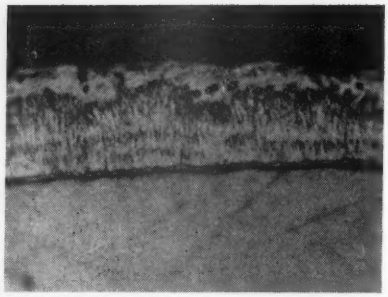

Fig. 11. (X500) Charcoal-wiped zinc coating on low-carbon rimmed steel wire which has been polished with 00 metallographic-type paper.

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Electro-Galvanizing of Wire in the United States

TWO processes, **Bethanizing** and the **Meaker Process,** have been developed in the United States and are being used commercially for the production of zinc-coated wire. A third process, the **Hubbell-Weisberg** process, is in the development state, and a pilot wire electro-galvanizing plant is now operating.

* * *

PRIOR to the development of these processes, others had experimented with electro-galvanized wire. In 1904, **Mr. Guy Meaker,** founder of the **Meaker Company,** left that company to join one of the larger wire companies in this country, which had become interested in electro-galvanizing of wire. (56). A unit for zinc-coating wire was installed at Rockdale, Illinois, and operated with varying degrees of success for some years. The results of the operation of this pioneer unit are not generally known, but apparently there was considerable mechanical and electrical difficulty.

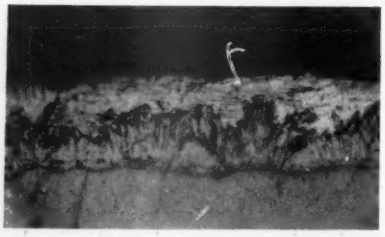

Fig. 12. (X500) Charcoal-wiped zinc coating on same wire as Fig. 11 except steel surface had been roughened with coarse abrasive paper.

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IN 1932, the first **Bethanizing** or **Tainton** process plant for electro-galvanizing wire was installed at Sparrows Point, Maryland. (57). This plant was designed to produce zinc-coatings heavier than had been produced by hot-dip galvanizing. The zinc-plating process used had been developed by **U. C. Tainton** over a period of years. While doing research work at Manchester University in England, **Mr. Tainton** in conjunction with **Mr. J. N. Pring,** had developed a zinc-plating process in which the electrolyte was a solution of zinc sulphate with 10 to 30 per cent of sulphuric acid from which zinc could be plated at a current density of 500 amperes per square foot. (58, 59). In 1910, an experimental plant was built at Sandbach, England. (60). Both British and U. S. patents state that the invention would be found useful for electro-galvanizing wire; also, that the high sulphuric acid content of the electrolyte might be used conveniently for extracting zinc from the ore.

* * *

THERE were several unforeseen difficulties in the practical operation of the process and as these difficulties became apparent, **Tainton** made developments toward overcoming them. While working on the first commercial application of his high acid, high current density process for producing electrolytic zinc at Kellogg, Idaho, in 1928, **Tainton** found the zinc deposits were contaminated with lead which had been mechanically carried over from the lead anodes then used. To overcome this difficulty **Tainton** developed the insoluble lead-silver anode. (61, 62). The

oxygen bubbles which were evolved at the insoluble anode rose to the surface of the electrolyte and, upon bursting, created a spray consisting of small droplets of the high acid electrolyte, which were a menace to health and caused rapid deterioration of the equipment. A foam blanket produced by cresylic acid was found to largely overcome this trouble. (63). When an electrolytic zinc plant was started at East St. Louis in 1929, current efficiencies fluctuated violently, zinc deposits tended to redissolve and occasionally no zinc at all would be produced. (64). The trouble was finally traced to small amounts of germanium which came from the zinc ore and a method was develped by **Tainton** for removing this troublesome element. (65). While experimenting with wire electro-galvanizing in 1932, **Tainton** found in desirable to anodically clean the wire just prior to plating and patented a method for doing this, utilizing the spent electrolyte from the plating cell. (66). This cleaning was not adequate and a method of electro-cleaning in molten sodium hydroxide was developed by **Tainton.** (67).

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THE distinctive feature of the **Tainton** process is that the electrodeposition of the zinc is made from a high sulphuric acid—high zinc electrolyte by means of insoluble anodes and the use of high current densities.

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THE **Bethanizing** or **Tainton** process was introduced in England in 1939 where it has been given the name **"Brylanizing."** (68, 69).

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THE first **Meaker** installation designed specifically for electro-galvanizing wire was installed at Trenton, New Jersey, in 1935. In 1936, a wire electro-galvanizing unit was installed at Chicago, Illinois. (70). As far back as 1905, **The Meaker Company** introduced an electro-galvanizing solution with which current densities of 70 amperes per square foot or higher could be used. (71, 72). At present, their wire electro-galvanizing plants use current densities in excess of 500 amperes per square foot. Long before 1935, the **Meaker** process was used for electro-galvanizing strip steel such as is used for box strapping. This required thin coatings on the order of 0.0001 to 0.0005 inches. (73). In order to adapt the **Meaker** process for producing heavier zinc coatings for wire, a process for cleaning the wire prior to plating was developed. (74). This process was essentially anodic cleaning in dilute nitric acid with high current density of 200 to 300 amperes per square foot. (75).

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THE plating cell of the **Meaker** process utilizes zinc anodes with an electrolyte solution of zinc sulphate with certain proprietary additions with the pH maintained between 2 and 4. The electrolyte solution is circulated counter current to the direction of wire travel to improve the quality of the zinc deposits.

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THE **Hubbell-Weisburg** process employs as electrolyte an ammoniacal solution containing a complex zinc tetrammine salt. (76, 77). Very pure and dense zinc coatings can be plated from this solution at current densities of 500 to 1000 amperes per square foot. These zinc coatings are very ductile and are adherent to the steel base. There is no tendency for occluded hydrogen in the steel base to cause blisters under the zinc coatings as sometimes occurs with acid plating solutions.

* * *

THE process may be operated either with soluble zinc anodes or with insoluble anodes of graphite or magnetite. (78). When insoluble anodes are used, the zinc in the electrolyte is replenished by withdrawing some of the partially depleted solution and using this to dissolve zinc from zinc ores, or other materials containing zinc compounds. After the replenishing treatment the solution is easily purified since it is of an alkaline nature.

* * *

Conclusion

IN the past twenty-five years and and especially during the past decade, much useful information has been obtained on the corrosion resistance of galvanized steel wire from outdoor corrosion tests in the United States and abroad. (79, 80, 81). In general, these test results indicate that various types of good hot-dip zinc coatings and of good electroplated zinc coatings, are, weight for weight of coating, to all practical purposes substantially equivalent in their ability to protect the underlying base metal from corrosion and that the greater the weight, the greater the protection. (73). Further, these exposure tests point the way to the intelligent selection and evaluation of the proper weight of coating to use under various conditions of atmospheric exposure. In specifying heavier weights of zinc coating on wire, it becomes an economic question whether the added life will be worth the added cost when all service factors are taken into account.

* * *

NO doubt, in the future as in the past, there will continue to be refinements and improvements in the art of wire galvanizing, and at present, it appears that zinc will continue to play a leading role as a protective metallic coating.

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SYNTHETICS FOR WIRE AND CABLE

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A paper presented before the Wire Association Annual Convention at Buffalo, New York, October 1946

TWENTY years ago, there was really only one type of rubber-like material available for the insulating of wires and cables. It was natural rubber, and it came from various parts of the world. The Dutch East Indies and that general area produced the most volume. South America produced what we consider the best premium grade called Up-River Fine Para. In those days, there were few cable engineers and fewer chemists and physicists interested in producing synthetics to compete with rubber. The low cost of producing natural rubber had some bearing on the situation, and even when the price was high, it was recognized that it did not reflect the true cost.

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HENCE, the first synthetics to develop a place in the wire industry had to fight their way in on the basis of their particular characteristics which put them in a place above competition.

Vulcanizable Synthetics

THE development of **Thiokol** was notable in that it was used as a covering over insulation in spite of its disagreeable odor and only fair physical properties. The reasons for its use were that it has excellent oil, solvent and weather resistance, and also, as it turned out later, it is far superior to rubber in resistance to diffusion of water. For most applications, it was necessary to provide the Thiokol with a fibrous braid for mechanical protection.

* * *

THE next material to make its own way into the field of synthetics was **neoprene** (at first called **Duprene**). This material at first had an odor not unlike that of a black and white animal prized for its fur. However, its remarkable sunlight and fire resistance coupled with better physicals than all but the tire tread types of rubber jackets, made it a natural tough sheath for natural rubber wires and multi-conductor cables. Added to these characteristics, its oil and solvent resistance, while not equal to **Thiokol**, was far superior to rubber. When investigation revealed that many rubber jacketed cords failed for reasons such as oil swelling, sun checking, fire and accidents which no cord would withstand, neoprene gradually took over almost all cord jackets. About the time the name was changed from the proprietary name Duprene to the generic name neoprene, the manufacture and composition were modified somewhat eliminating the odor. During the war, the Government built manufacturing facilities for neoprene and its use has expanded many fold. It is one of the best general purpose vulcanizable sheath materials known. At the present time, and for the past six years, more than two-thirds of The Okonite Company's rubber insulated wire and cable is protected by **Okoprene** (compounded of neoprene).

* * *

NOT the least of the valuable properties of neoprene is its inherent ozone resistance. (Ozone and sunlight resistance have been reported by the Bell Telephone Laboratories to be of such similar nature that mild ozone can be substituted for sunlight testing of rubber-like materials). Our serious entry into the manufacture of **Okoprene** covered wire was caused by studies that showed unshielded 5000 volt braid covered cables failing from surface discharge, where the fibrous coverings when wet drained enough charging current at a ground point to rot the coverings and attack the insulation by ozone or burning. We found that **Okoprene** absorbed so little water that no current was carried along its surface and hence discharge was unlikely. In addition, ozone from other sources of discharge had no effect on the **Okoprene** under reasonable installation conditions. Starting from that development, the use of **neoprene** as an outer protection spread to all kinds of single conductor cables in place of braids.

* * *

IN most of the instances cited here and in the following discussion, there will be repeated reference to materials by their trade or proprietary names, but in all of the cases of the vulcanizable synthetics, the character of the finished product depends to a great extent on the compounding skill of the cable manufacturer. Most of the vulcanizable synthetics are used in the same way as natural rubber, or as a raw material to which compounding ingredients impart considerable influence.

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AT the start of this talk, we gave a chronological cast to the synthetic development. However, having started with vulcanizable materials, we will continue with them and handle the thermoplastics by themselves.

* * *

IN 1936, there appeared a material called by the chemical name polyisobutylene and known by the trade name of **Vistanex.** While this material derived from isobutylene gas was not truly a vulcanizable material, the only way it could be used was by mixing it with natural rubber and vulcanizing the rubber. In this use, it gained varied success due to the fact that the **Vistanex** seemed to cover the rubber and protect it from ozone or corona attack, thereby making possible an ozone resistant insulation also having low capacity, the latter characteristic being an advantage not previously obtainable with rubber. However, for some unaccountable reason, mixtures of rubber and Vistanex occasionally failed without reason, and this type of insulation was abandoned. In trying to help the situation, the Standard Oil people developed a type of **Vistanex** which had a small amount of unsaturation (obtained by adding isoprene or butadiene to the isobutylene gas before polymerization). This synthetic was named **Butyl** and was found to be so much better than natural rubber for inner tubes that the Government sponsored large manufacturing plants at Baton Rouge. As a result only a small amount of **Butyl** has been released for cable insulation, and it is beginning to find some use because it is cheap (15½ cents per pound), and can be loaded with fillers and yet produce a fairly good insulation with some ozone resistance.

* * *

THE first of the German Buna synthetics to be manufactured in this country in quantity was **Buna N,** called by various trade names including **Hycar OR, Perbunan,Chemigum,** etc. This material made by polymerizing butadiene with acrylonitrile is extremely oil resistant and tough. It has found considerable use in oil and gasoline lines, and occasionally in cable sheaths where oil resistance is of prime importance. It excells neoprene in oil resistance, but lacks neoprene's flame and sunlight resistance.

* * *

PROBABLY the greatest German contribution to the United Nations' victories over Italy, Germany and Japan was the development of **Buna S,** manufactured here under Government sponsorship and called **GR-S.** This synthetic copolymer of butadiene and styrene uses simpler processes and equipment than neoprene and is about as close to being a substitute for natural rubber as any material so far developed. It is being produced and sold for 18½ cents per pound which is less than the price for which the Dutch or British seem willing to sell rubber. Since it yields comparable insulations for many uses and appears to have better heat resistance than natural rubber, it has a good opportunity to remain for a long time as a general purpose raw material for both insulation and tires. We have found it to be somewhat less reliable electrically and physically than Fine Para rubber when used in comparable insulations and are currently using natural rubber wherever we are permitted to do so, but apparently many cable manufacturers having learned to use it are reluctant to give it up at its present price which is about two-thirds that of natural rubber. A few comparisons of natural rubber versus GR-S compounds are shown in Tables No. 1 and No. 2.

* * *

THE latest vulcanizable synthetic to find use in wire and cable insulations is **Silicone** rubber. Fundamentally different from the common hydro-carbon types of rubber-like materials both vulcanizable and thermoplastic, **Silicone** rubber uses the element **Silicon.** The resulting polymers are characterized by unusual temperature range of usefulness from -70°F to 300°F, far exceeding any of the previously mentioned materials. At the present stage of development, the Silicone rubber compounds are somewhat tender to cutting and other mechanical abuse and are customarily protected by such heat resisting materials as fiberglass. However, the ability to remain rubber-like at 300°F for extended periods and the asbestos-like flame resistance mark it for many uses.

Thermoplastic Synthetics

THERMOPLASTIC insulations cover the class of materials which soften with heat and harden with cold and which may be softened and hardened repeatedly without changing the material itself.

* * *

IN 1933, the **B. F. Goodrich Company** developed a synthetic rubber-like thermoplastic called **Koroseal** which was destined to become with its Vinylite counterpart the primary ingredient of Navy Shipboard Cable, virtually eliminating natural rubber even before Pearl Harbor. This thermoplastic, now known to many of you as **Geon** is the plasticized polymer of vinyl chloride. The Okonite Company was privileged to introduce this synthetic to Navy cable and actually used about 280,000 lbs. of the first 300,000 lbs. produced. The characteristics of the Vinyl plastic are

TABLE NO. 1

Heat Resistant Types GR-S Rubber vs: Natural Rubber Properties

	40% GR-S Rubber	35% Natural Rubber
Tensile Strength — P.S.I.	1125	1925
Elongation — Inches	2 to 10.5	2 to 11.5
Resistance to Cold	Excellent	Excellent
Heat	Excellent	Excellent
Ozone	Poor	Poor
Oil	Poor	Poor
Sunlight	Fair	Fair
Flame	Poor	Poor
Moisture	Good	Good
Dielectric Strength —Volts/Mil	400-500	450-550
Insulation Resistance Constant 1000Ft. — 60°F)	11,150	22,500
Dielectric Constant (60 Cycle — 40 Volts/Mil)	5.5	4.5
Power Factor — Per Cent (60 Cycle — 40 Volts/Mil)	3.1	2.0

toughness and resistance to heat, oil, fire and sunlight. The plasticizer used may have a marked effect on all of these properties and in addition the low temperature flexibility. Vinyl plastics are the only insulations recognized by the Underwriters' Laboratories for use in building wiring without some sort of protective covering, and then they are allowed with lighter walls than most insulations. The electrical properties of these materials is such that they are usually used on 600 volt systems although occasional installations up to 3,000 volts have been used. It is generally true that thermoplastic insulations require thermoplastic sheaths, but it has been found possible to vulcanize neoprene sheaths over vinyl insulated wire where ease of bending at low temperatures was of prime importance. From the primary use of Vinyl plastics on wire and cable, their field of use has multiplied many-fold especially in the consumer goods market where they are competing with cotton and leather as well as rubber. At present the Vinyl plastics are somewhat standardized and supplied ready to use. However, as their use broadens, the base synthetic Vinyl resin will probably be used more and more as a raw material such as natural rubber, and the compositions of the individual processor will be varied to suit the finished article.

* * *

ANOTHER general purpose thermoplastic material is polyethylene sometimes called **Polythene** and consisting of an unplasticized polymer of ethylene gas. This material resembles paraffin in looks, smell and burning properties, but is flexible at temperatures from 45°C to 100°C. Developed in England to its present degree of polymerization about 1938, it was used here for low loss high frequency cable insulation. It is a non-polar dielectric and remains very stable in capacity and power factor at all frequencies. Currently, it is still being used for high frequency and promises to be the ocean cable insulation of the future, having less absorption of water than any comparable electrical insulation. Among its useful properties are resistance to oils, chemicals and solvents up to 60°C and excellent sunlight resistance when properly protected by opaque fillers and an antioxidant.

* * *

TABLE NO. 2

Oil-Base Ozone Resistant Types GR-S vs: Natural Rubber Properties

	GR-S Rubber	Natural Rubber
Tensile Strength — P.S.I.	525	525
Elongation — Inches	2 to 8	2 to 8
Resistance to Cold	Fair	Fair
Heat	Excellent	Excellent
Ozone	Excellent	Excellent
Oil	Fair	Fair
Sunlight	Good	Good
Flame	Poor	Poor
Moisture	Excellent	Excellent
Dielectric Strength — Volts/Mil	400-500	400-500
Insulation Resistance Constant (1000 Ft. — 60°F)	14,000	15,000
Dielectric Constant (60 Cycle — 80 Volts/Mil)	4.0	4.2
Power Factor — Per Cent (60 Cycle — 80 Volts/Mil)	3.0	3.0

THE synthetics so far described constitute a large portion of the materials used for wires and cables. Table No. 3 gives a comparative listing of typical characteristics so that you may judge some by what you know of others. The comparison is primarily on their abilities as sheaths or protective coverings.

* * *

AMONG the newer synthetic thermoplastics finding increasing use in insulations and sheaths is **Teflon** (poly tetra fluoroethylene) in which some of the hydrogen atoms have been replaced by fluorine atoms, but in a "symetrical" manner so that the resulting polymer is excellent electrically. Actually **Teflon** has the best low loss electrical characteristics of any flexible solid and has physical properties of a higher order than all others. It looks much like paraffine except that it does not soften below

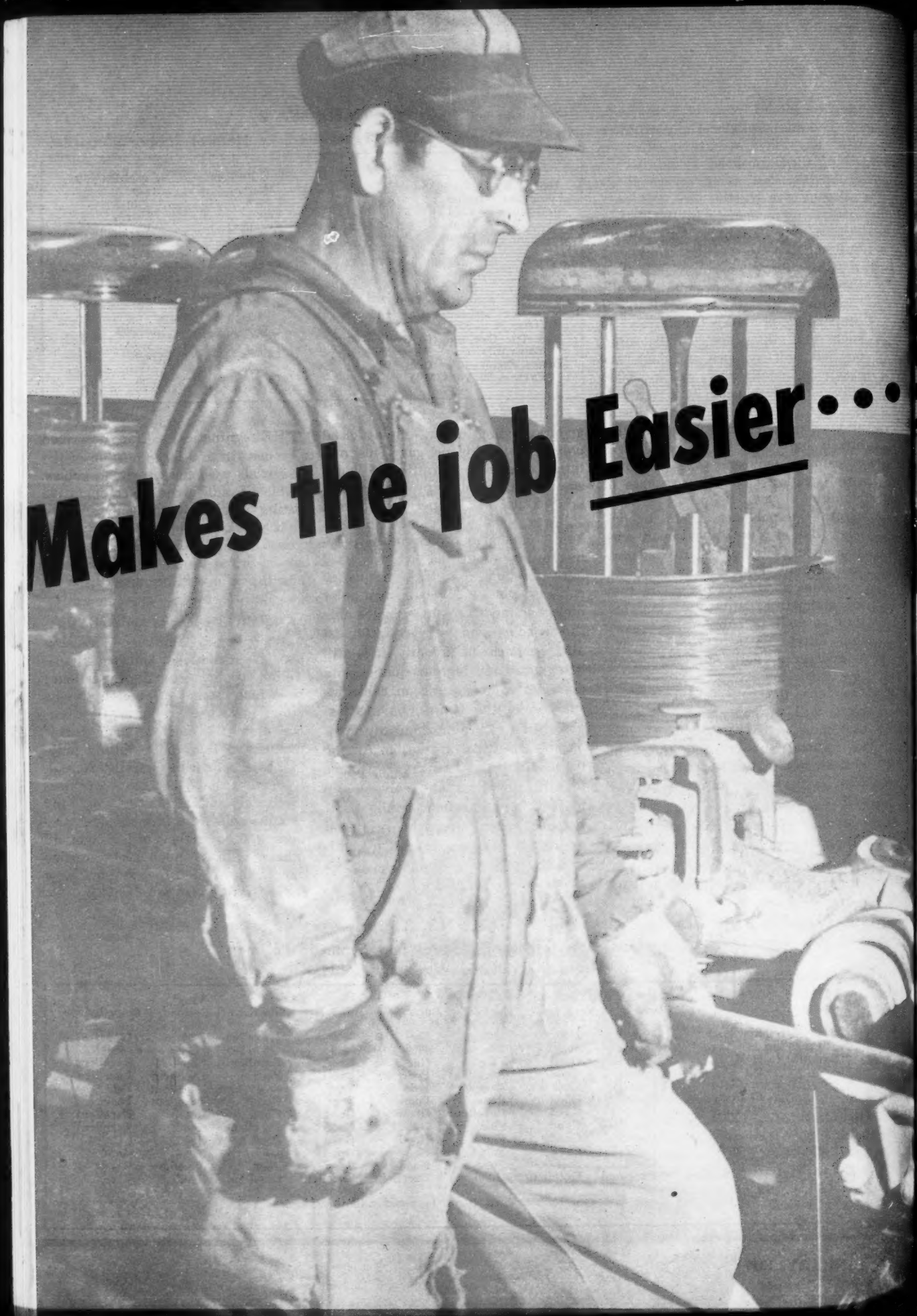
(*Please turn to page* 98)

TABLE NO. 3

Comparative Properties of Natural and Synthetic Polymers Used in Insulated Wire and Cable.

	Natural Rubber	Neoprene	Thiokol	Buna S	Buna N	Silastic	Vinyl Resins	Polyethylene
Tensile Strength, P.S.I.	4000	2600	1500	2300	3000	400 to 700	3000	1600
% Elongation	550	400	200	400	400	75 to 300	250	400
Resistance to Heat	Fair	Good	Fair	Good	Good	Excellent	Good	Excellent
Oil	Poor	Good	Excellent	Poor	Excellent	Poor	Excellent	Excellent
Sunlight	Fair	Excellent	Excellent	Fair	Fair	——	Excellent	Fair
Flame	Poor	Good	Poor	Poor	Poor	Good*	Excellent	Poor
Moisture	Good	Good	Excellent	Good	Good	Good	Good	Excellent
Cold	Excellent	Good	Fair	Good	Good	Excellent	Good	Excellent
Abrasion	Good	Good	Fair	Good	Good	Poor	Good	Fair
Impact	Good	Good	Fair	Good	Good	——	Good	Good
Tear	Good	Fair	Poor	Good	Good	Poor	Excellent	Good
Deformation	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Good	Good

*Does not flame but gets redhot, then turns to powder-like residue.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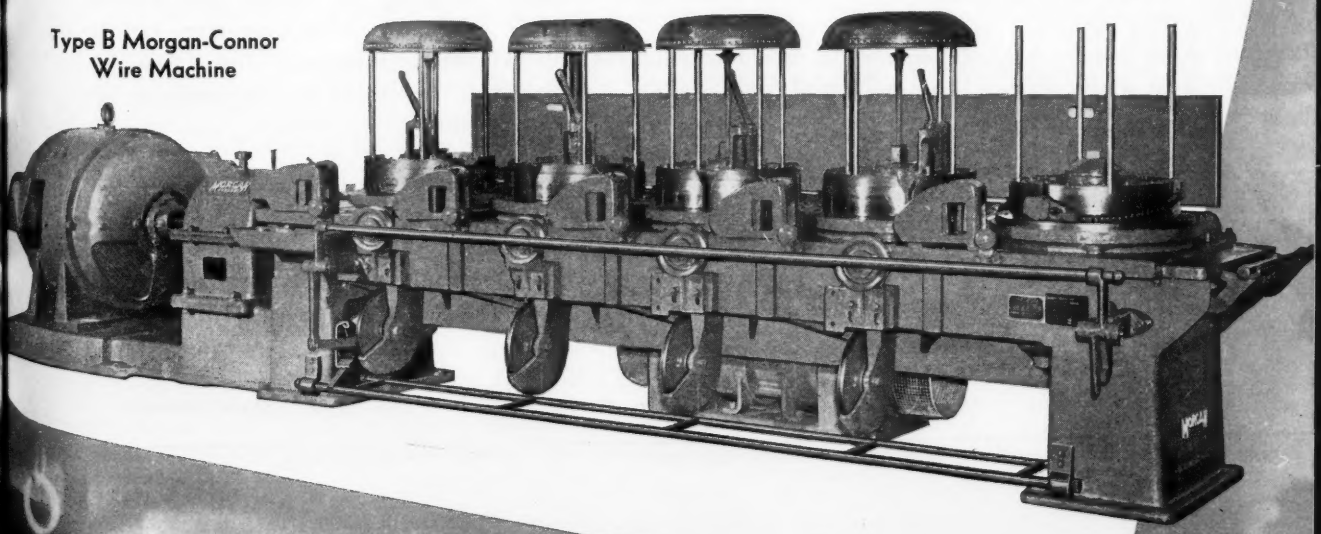

ALUMINUM WIRE

AT the recent Annual Meeting of the Wire Association, before OPA had passed out of the picture, there were some who thought that Mr. H. S. Spaulding, the author of the paper entitled "Aluminum Wire Fabrication", was a bit too optimistic about the future of aluminum in the wire industry. But today with copper selling for 17.50 per pound (when available) and aluminum wire at 15c per pound, here is little doubt that aluminum wire is going to be used in ever increasing amounts, especially in the wire industry. Already several manufacturers of electrical conductors have started their research and development departments to explore the possibilities of substituting aluminum wire for copper wherever possible. No fabricating difficulties are anticipated for in most cases aluminum can be rolled and drawn in the same machines as those originally designed for copper.

* * *

VERY recently, a prominent statistician stated that the United States will be an importing instead of an exporting nation of copper for many years to come, a situation quite different from what it has been up to now.

The comments made in this article are those of an executive in a large copper refining company. They reflect a condition that may force aluminum wire into the limelight to a degree not considered before, based upon purely economic factors. * * *

THE "experts" are prone to remind us that the electrical conductivity of aluminum is only 60% of that of copper. This difference in physical property is, of course, all-important in many cases, but on the other hand, there are applications where other properties of aluminum can be utilized to offset the lower conductivity. Then, too, the size of the conductor can often be increased without material by changing the design of the equipment.

* * *

ANOTHER important factor in favor of aluminum over copper is the saving in weight, the specific gravity of aluminum being 2.70 as compared with 8.94 for copper or only about 30%.

ON a footage basis, allowing for the difference in electrical conductivity, (aluminum has a conductivity of 62% compared with 100% for copper), in ordinary wiring about one-half pound of aluminum wire is the equivalent of one pound of copper wire.

* * *

ALUMINUM wire can be readily insulated, especially, with such material as latex, and it is reported that aluminum wire so insulated resists ordinary corrosion as well as does copper. The latex insulation is said to be thinner that the insulation ordinarily applied to copper. One concern, the United States Rubber Company, is already using aluminum wire in place of copper for building use in a large part of all the insulated wire it produces.

* * *

WHERE no marked increase in the diameter of the wire is required, aluminum wire can be used in the same conduits as those designed for copper and without difficulty. Aluminum wire can be readily soldered if fluxes especially developed for the purpose are used.

TO WIRE MILL MEN

Have you considered joining the Wire Association? You are cordially invited to become a member. Dues are $15.00 *a year, which includes a subscription to WIRE & WIRE PRODUCTS and a copy of the Annual Buyers Guide.*

THE WIRE ASSOCIATION

300 MAIN STREET STAMFORD, CONN.

WIRE ASSOCIATION PROCEEDINGS

Meeting, Monday, October 21, 1946 — 2:00 P.M.

John C. Calaghan,
Canada Works, Steel Co. of Canada, Ltd.
Hamilton, Ontario, Canada

Chairman of Meeting

OPENING ADDRESS	Rowland M. Hussey,	President of the Wire Association
LECTURE: Present Day Labor Problems	by John L. Sanderson, Asst. Supt. Wire Mills	Keystone Steel & Wire Co., Peoria, Ill.
PAPER: Demineralized Water in the Wire Mill	by Dr. F. R. Morral, Metallurgist	American Cyanamid Company, Stamford, Conn.

Openning Address By Rowland M. Hussey, President, The Wire Association

The Technical Sessions of the Wire Association convened at 2:00 p. m., with Mr. John C. Callaghan presiding as Chairman of the first session.

Secretary Brown: Gentlemen, will you come to order?

Mr. John A. Moritz was supposed to be Chairman of the meeting today, but has been unable to attend because his mother is dying and he can't get here.

Mr. John Callaghan has kindly consented to act as Chairman of the meeting. Mr. Callaghan! (Applause).

Chairman Callaghan: It is my happy privilege to open this seventeenth gathering of the Wire Association.

The first meeting was held in 1930, and the small seed of friendly interest, then sown, has so expanded the Wire Association's activities to a point today that here we are meeting each other as friends, willing to transmit to one another information that is helpful not only to the industry as a whole, but to the members as individuals.

In welcoming you here today, I hope that the proceedings, as they go forward, will be of interest to everyone; that you will make your individual contributions to the discussion without timidity and with a frankness that you know will not be carried into the final records if you so wish. I would ask every individual as he speaks to the subject to announce his name so that the record may be properly made. I can assure him that those words that he may utter are absolutely confidential until he approves their publishing at a later date, and even then his name will not be mentioned.

In the proceedings that are to follow, I hope you will feel that warm, friendly feeling of being together and free to express your thoughts.

The first item on our program today is the Presidential Address by Mr. Hussey. He needs no personal introduction from me. You all know him and we await Mr. Hussey's address with interest. (Applause).

(President Hussey presented his Opening Address.)

On behalf of the officers and directors, I extend to you, gentlemen, a most cordial welcome to this, the 17th convention of the Wire Association; I might well date this meeting as the year 2 By-ourselves.

You will recall that prior to the October convention last year, we met under the protecting wing of the National Metal Congress.

Early last year, a momentous decision had to be made; whether we would continue to meet jointly with other societies at time of National Metal Congress or forego some few of the advantages thereby obtaining and meet at a different time and in a different place, if necessary. Your directors faced the issue with some trepidation, but resolutely decided to launch out on convention work as a separate technical society by itself. I believe results of last year's meeting speak for themselves and repudiate judgment exercised by your directors and officers. Indications at the moment are that registration and attendance this year will further enhance the soundness of that decision.

★ ★ ★

It is gratifying to note the enthusiasm, interest and attendance in prospect for this convention, as determined at the moment by what we know of reservations already made, or the attendance we see here in this opening session.

★ ★ ★

This is the second convention following the end of a job well done for the Armed Forces. When we met last year in Chicago, we were faced with reconversion; changing from a War Time pace, in which the Wire Industry played a big and all important part in the War effort, to the task of recuperating in the Home Front effort.

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Reconversion from the production of wire and wire products for the Armed Forces to the production of goods for civilian use did not present, I believe, such a problem to the Wire Industry as that presented to some of the other industries. Some of us may have a few wire drawing machines, used in producing Signal Corps wire, that have not yet become fully loaded with domestic items, we may have some straightening and cutting equipment, or some annealing equipment that is still taking the rest cure after the heavy load they carried during the bullet core rush, or some of our stranders and closers in the rope mill are not again taxed to capacity like they were when so much rope was in demand for aircraft and ships. Yet, few changes, if any, of a mechanical nature were or are required to put such equipment in production on wire needed through the country today.

I believe we can write off the master of physical or mechanical reconversion in the Wire Industry as done. We are revamping, modernizing or expanding in some favored lines, but work of this sort is only normal and cyclic.

★ ★ ★

We are not done with reconversion, however, and the reconversion I have in mind presents a formidable problem, serious in nature and discouraging in aspect. I mean we have the job before us of reconverting men; men of the rank and file. Men must be converted again to the idea that they must work to produce, live and prosper, and for their own good they must produce to the point where supply meets demand. No law will work to their advantages as will the old, natural one of supply and demand. They must do a fair day's work for a fair day's pay — after all, the story about the goose that laid the golden egg is only a fairy tale. Maybe some brilliant person would say, first reconvert yourself so you will acquire the perspicuity for reconverting your men. If there is a man present who knows how to make a man come to work when he doesn't want to or to do a fair day's work when he is not so disposed, then I'll quit talking and start listening.

★ ★ ★

The Industry needs men. Thousands have been released from service and many of them have returned to jobs held prior to induction or enlistment and are doing good work. Some of them, with new ambitions engendered by specialized training in the services, are seeking new jobs or moving to other operations in the plant, but they are back in industry ready to do their bit. The 52-20 club, however, looks good to too many of the returned Vets and absenteeism among all groups, old and new alike, is running at a high rate.

★ ★ ★

I believe we have an excellent program and that the papers will hold your interest. We want good attendance and, of course, we like to start meetings on time. We want discussions and questions. I would like to have discussions snappy, to the point, with due respect for time used so all who want to participate can be heard.

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With those remarks, in opening the first technical session of the Wire Association Convention this year, I will turn the meeting over to the Chairman.

President Hussey: Now, with that formality over, in a rather informal manner I will turn the meeting back to the Chairman. (Applause).

Chairman Callaghan: Thank you, Mr. Hussey. We appreciate very much your Presidential remarks, and particularly those thoughts that lead into the next subject that is coming before us, namely "Present Day Labor Problems".

Usually labor-management problems are approached defensively, and in that defensive attitude of mind we frequently lose some of the facets of the problem that will tend to draw us together rather than put us apart. Labor and management are both necessary to work on the same plane of cooperation to make a successful result.

I want to say to the younger men here today that they should feel free to interject their thoughts, with reasonable deference of course to some of the older fellows who came up from the sixteen cent an hour period. We now will hear from Mr. Sanderson, who is going to give you a talk on his subject, "Present Day Labor Problems." Mr. Sanderson! (Applause).

(Mr. John L. Sanderson, Assistant Superintendent Wire Mills, Keystone Steel & Wire Company, Peoria, Illinois, presented his lecture on "Present Day Labor Problems.") (Applause).

Chairman Callaghan: The meeting is wide open to ask Mr. Sanderson any question you have in mind without reservation.

A member: All through the talk Mr. Sanderson mentioned seniority. Just what do you mean by seniority?

Mr. Sanderson: When I wrote this paper I had in mind—I am glad that question came up because I had this in mind.

Any new employee that starts in the plant, the first day he starts working, he starts accumulating seniority.

In our drawing room, which you might say is the experimental place for human beings, I think we will all agree with that because temperaments run very different, he is given a probationary period during which we put him on what we call the rookie or beginner's jobs, where he learns to draw wire. It happens to be our bench job. We call it Bench 6. I know that some of the boys here will recall that.

He starts accumulating seniority the very day he goes into the plant, after he has passed his probationary period, and is a full-fledged employee and is working, say, in the drawing department. He maintains that date as long as he works there without a break in seniority. Where there is a layoff for a period of six months, he may have continued seniority.

The problem might arise that suppose an employee comes from over the yard into the drawing department. Where does the seniority start? Each employee coming into the department, or into the wire mill and steel mill both, he has a department date and a plant date. When he comes into the drawing department after working in the yard, he retains that yard date or plant date, and his seniority in the drawing room starts the very day he goes drawing wire.

Who would you recognize if two men came in the department the same day, one of whom worked in the yards, and the other was a brand-new employee? The first thought would be that the fellow who worked in the yards because of more plant seniority. You'd say he has more seniority because he's been in the plant longer but that isn't true. The foreman has the right to place either man ahead of the other on the ability clause.

I might say that the last talk we gave we mentioned about having seniority lists in each one of the departments which is made up, and that's been going on since 1936, and that list is revised every six months, and there is a copy posted in the department. The committee is given a copy. When I say the committee, I mean the department commitee and the union, and that list is revised every six months.

We had just the other day a case come up where seniority lists were closed since 1941. One fellow thought he had three or four days over the other fellow, and rightfuly so. It was an error.

I don't know if I explained what you meant.

Chairman Callaghan: We have been accustomed to shy away from the word seniority in favor of length of service. You have been speaking of length of service rather than seniority, in our way of thinking. Ability to do the job and physical fitness are the two other things included in seniority besides length of service.

Mr. Sanderson You are right. Five men come in the same day, and the foreman has the right to place either of those five as he sees fit ahead of the other four, and so forth. Is that right?

Chairman Callaghan: Yes.

Mr. Sanderson: I was glad, gentlemen, that John is Chairman here this afternoon. I always relish the idea of taking some good advice from gentlemen who have been through the mill. I am sorry Mr. Moritz wasn't able to be here today because he could be right there with us on the thing too.

Chairman Callaghan: Next question.

A member: Mr. Sanderson, you said something about absenteeism, and I know that that is a subject that everybody is thinking about these days. You stated that you penalized a man, but you didn't tell us anything about what sort of penalty it was.

Now, we have that same trouble. Our absenteeism is about as bad as anybody's. It amounts to about ten per cent a month. We had a meeting with our union committee, and we decided to try to stop this absenteeism, and we met and formed a supplemental agreement or contract in which three unexcused absences from the plant in any ninety days resulted in the man being fired — three unexcused absences in any ninety days, and the man was fired.

If we didn't hear from that man. we marked him down as unexcused. But we did him the privilege of meeting with the company and union to see whether that unexcused would stand or not, and we have already, since we put this into effect about three months ago, cut our absenteeism in half.

Mr. Sanderson: As long as you can get the union, as I see it, to talk with you on that — at least get them to talk and listen a few minutes, and if they will start nodding their heads just a little bit forward, you can usually do something about absenteeism.

You ask what our penalties are. The first offense resulted in a three-day layoff; then a week; and then discharge. We set up as three different penalty divisions, and the most remarkable thing is that the fellows do abide by it. I mean if they are going to be off they will call in and that is what counts because if you know a guy is going to be off and he is man enough to call up and say he wouldn't be to work that day, you appreciate it a hell of a lot more than if you miss him and wonder where he is.

It's the same with our wives. If we stay out all night and don't call, they wonder where the hell we are.

Chairman Callaghan: Next question.

A member: Mr. Chairman, Mr. Sanderson described fully his bidding system. That brings to my mind my experience in thinking along the same lines, particularly on a vacancy or a new job coming up where I thought of advertising a new job a good deal along the lines of the way trainmen and engineers and firemen jobs are advertised. Management found reason why it shouldn't be done that way, and we didn't pursue that line of thought any further.

As against the bidding system, I think there is an alternative. It seems that way in my opinion, anyway. It seems to me that you could establish a line of progression. Now, some mills' line of progression might not mean much, or they couldn't make much out of it, but in this operation where I am, line of progression does seem to count for something, or quite a bit, and the union in our case has demanded line or progression charts and that line of progression, it usually winds up the end of the line will be that job which the union, supporting their members, would consider to be the highest-earning job, but not too much of the hard work with it either, and you get into some ramifications there as to what the end of the line is or the last job to which the oldest man would aspire. These are usually measured in terms of earning power, excepting in those cases where the earning power at the end of the line means a lot harder work and some job in between the lowest-earning job and the top one.

The line of progression chart that we have had fashioned with the approval of the union seems to work pretty well, except in the case of the oldest man going onto that job. We say he goes onto that job if he has the skill and physical ability.

That is about the only place where you get into a wrangle on it. If you have your line of progression chart established and approved by the union, it's pretty much of a job taking a man when a vacancy occurs and moving the oldest man in point of service up there on wire-drawing work, provided you feel he is physically able and skilled enough to do that work.

You mentioned one thing in your talk, Mr. Sanderson, that I have no question. Rather, I want to lend emphasis to it a little bit and that is the value of records.

Now, I am dealing with a national union. We have had a lot of headaches, of course, and a lot of hard work, but it has been

my experience that when you have good documentary evidence — facts and figures — with your memoranda and reports dated, and in certain kinds of reports and instances a reliable witness to the transaction (preferably a man, as a witness, not too closely connected with the supervisory staff), it stands you in good stead later on when you get into the meeting with the union men. I have learned from experience that you can't have too much reliable, factual information that you can stand back of as proof, or have it proven by an audit of the records if you want to open it up that wide.

In the matter of penalizing men, our records again become valuable, and I think we have a pretty complete system in the matter of handling penalties. We have a printed form — that is, one of our forms has a form number, and it is called a reprimand or suspension slip. When a man gets into trouble, or we have occasion to discipline a man, or even reprimand him, or no matter how light or severe the reprimand might be, the first thing — the first step — is to fill out that form, making copies as required. But in any event, give one copy to the man himself. There is space there if you want to use it to tell him what to expect or what he may expect in case he does it again.

In case he does it again, another reprimand slip is used — the same form — and the action is noted right on the slip. If it is a suspension, why the same report is used and he is given a suspension for two or three days.

Now, if he has had an initial reprimand, and maybe two or three more reprimands filed against him (he has the copies if he wants to keep them), then the time comes to take action. Suppose we want to fire the man. He is first given a five-day initial suspension and the form is filled out that way, and he is told by the foreman that in those five days he has the privilege of going to his department superintendent either with or without his union representative (just as he chooses), to discuss the matter with him — with the superintendent. The five-day suspension still stands, however.

At the end of the five days, he is told he is to come back and get the verdict on further action, if any, and in any event, before a man is discharged, he is first reprimanded at least one time—maybe several times with warnings, then given a five day initial suspension, and then, if his case warrants further penalty, he is given something beyond that.

But it's all on record, with slips to exhibit. We ask him to sign the slip at that time the witness signs the slip. Sometimes he refuses, but anyway, it is right in line with your keeping records — something you can exhibit later — and it has stood us in good stead in many cases.

Mr. Sanderson: Thank you.

A member: The thing that ought to be made clear is that a lot of department promotions were heretofore that a man stayed on the old jobs, before the union came in. They may have seniority in the job if you are going by strict seniority, but on the job they don't have it, and as a result, even if you have an agreement with the union, after that is in effect two or three years, it begins to come down to these men and then you get into trouble because a man claims he is in the department longer, even though he doesn't have seniority on the particular job, and he wants that job, and he stands pretty well with the union, and they will put up a fight. If he doesn't, he doesn't have much chance, but that is one of the weak spots of the progression system. We have tried it, and it is all right in some ways, but it is just another system.

Mr. Sanderson What system do you use over there now?

A member: We have that in some departments, especially with jobs like crane men and jobs of that kind. We have it in some departments also where there is a progression chart setup, and some of these charts were made by the unions themselves, and now they are wrangling about them because they reach this point I just brought up.

A member: I think the gentleman is talking of job contract. No, we don't have that, and you will run into trouble trying to appease both factions — I mean one asking for one thing and another for another. Where you'd run into trouble and where we have it is where men work up to one of the higher jobs and there is a layoff coming and you keep a new man on the job and lay off a man who has been on the job a longer time because of the length of time in the department. It is a case of deciding one way or another, and I don't know what you would do.

A member: We have both in some departments — lines of progression like those established there — but in any case, anybody that took more than thirty days to be trained for the job, and in the case of a layoff, no one outside of that department could (even though they had more seniority), touch any of those protected jobs.

Now, we use in the case of layoffs a total length of service with the company basis as seniority. In the case of vacancies or new jobs, the length of service in the department gets the first choice.

We were probably very fortunate in having an agreement with the union on ability because they agreed that ability would be if the man did the job before, and that is on the company's records as such, then he had demonstrated ability. I think maybe we were a little bit fortunate in getting that agreement.

But in the case of layoffs, total plant service is counted, and in addition to having a department reshuffle, we have a divisional reshuffle, and a final plant reshuffle. In other words, we give a man three chances to use his seniority before he goes out the gate.

Chairman Callaghan: Are there any further questions or explanations? There are a lot of thoughts churning in your minds, gentlemen. You have all had experiences some of which have irritated you very thoroughly, some of which you have poorly handled, others which you have handled very successfully and tactfully. There surely is some information that can be carried over to the other person whose lot hasn't been as happy as yours if you have done the job of labor-handling successfully.

I would not like the meeting to just have a negative approach to this labor problem because there is too much constructive thinking in this organization to just leave it as it stands right now.

There is a very interesting passage, if I might quote it informally to you, which is taken from the fourth act of "Julius Caesar." It relates to that incident where Brutus, having killed Julius Caesar, is just approaching the Battle of Philippi and his final end, and in talking to his friend, Cassius, said, "There is a tide in the affairs of men which, taken at the flood, leads on to fortune; omitted, all the voyage of their life is bound in shallows and in miseries."

Well, usually, to the school boy that is the end; you never know what comes after it, but the real meat is afterwards: "On such a full sea are we now afloat, and we must take the current when it serve, or lose our ventures."

Now, a lot of us are on the tide right now of taking advantage of certain constructive thinking, and on such a tide, if we don't take advantage of it, we are going to lose our ventures as management in the constructive handling of labor.

I cannot emphasize too much that the great advantage of having here men who are managing labor is the opportunity of transmitting or passing over of constructive thought, and we should take the current when it serves right here and now, or possibly lose our venture in the proper handling of our problem. That is the real meat of this convention, and of this particular part of our program. If you don't talk it over here, you should talk it over in the corridors or in the rooms, because that is the great advantage and value of coming together.

Now, there must be some other constructive thought here. Mr. Clark!

A member: I am not in the wire mill business, so maybe you will forgive me if my remarks come not as from a philosopher, but as from a man who has been supervising about 400 people in the production of products that serve the wire industry. This is general comment, and not specific.

In taking my job, I found, or at least I thought I found, that the greatest weakness in our complete setup was the fact that labor administrative jobs — executive jobs — didn't look at the industry as a unit. Each felt in his own place defrauded because he didn't know enough. Now, most industries in the last seven years have lost a great deal of their old-time character. You don't recognize it because the replacement has been gradual. Of a thousand employees in any company, I suppose there are eight hundred old ones, two hundred new ones. The two hundred new employees have tended to color the industry.

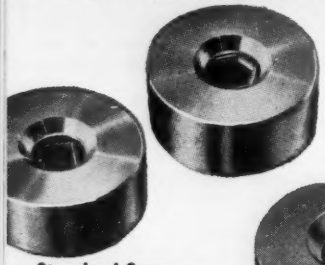
Now, everybody in a plant wants to feel a part of it, and the feeling of these pockets in which they get insulated almost from the first tends, in my opinion, to make the average worker so frustrated that the meaning of work and the general significance of that work to a man's outlook on life is lost. When I undertook my job I first sought to heal that breach or those breaches that existed, to make everyone in the organization aware of the part they played in the whole.

I have a room about half the size of this, and I call it the "wailing wall". The reason I use that is the Jews, always when they have an argument, repair to the wailing wall and try to redress the wrongs that have been done. But in our case it is for understanding of the job, not particularly in relation to senioriity or anything else. You have been talking about a negative approach. I wanted a positive approach as when a man doesn't understand something he is always ripe for confusion or frustration.

So, it doesn't make much difference to our organization what the subject is, when there is misunderstanding. I feel that there can be by education, if you

(*Please turn to page* 87)

COMPLETE RANGE OF DIES



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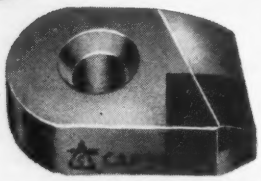

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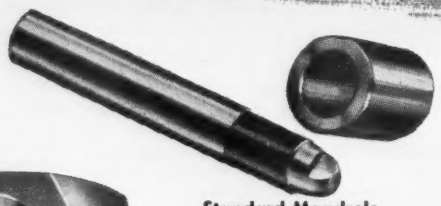

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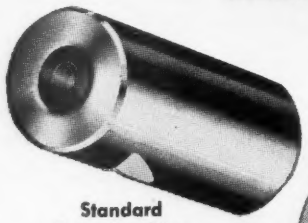
Standard Round Hole

Standard Guide Rings



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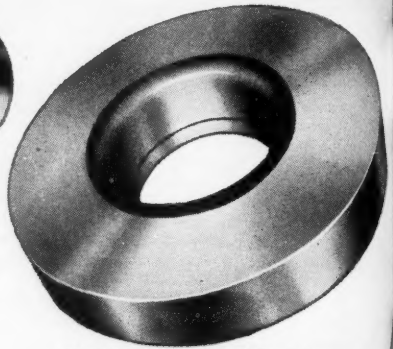

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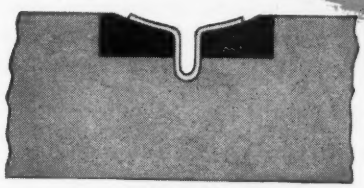

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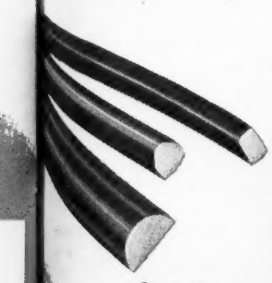

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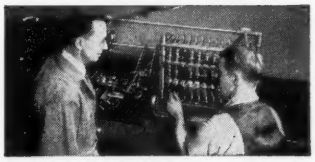

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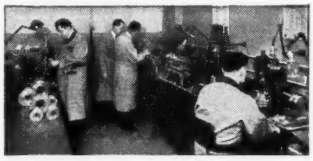

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I will now ask Dr. F. R. Morral to give his paper on "Demineralized Water in the Wire Mill." Dr. Morral!

(D. F. R. Morral, Metallurgist, American Cyanamid Company, Stamford, Connecticut. presented his paper, "Demineralized Water in the Wire Mill.")

Chairman Callaghan: One of the interesting parts of our convention is that diversity of problems that may be presented to us. We have gone from labor problems to the forum now where the chemists and metallurgists can have their say.

A member: Can Dr. Morral tell us how much to add to those figures for capital cost?

Dr. Morral: I do not know; it depends on the size unit.

A member: What is in those tanks?

Dr. Morral: Synthetic resins.

A member: What kind?

Dr. Morral: I can't tell you, but Mr. Case may be able to.

Mr. Case: I may be able to give you this information, although this isn't, strictly speaking, in my department.

There is a certain amount of chemitsry involved here which deals with the fact that while these resins that Dr. Morral is referring to are not soluble in water, they will react with the impurities dissolved in water.

For example: in acid removal one resin absorbs the acid radicals, and the resul t can be obtained by the introduction of nitrogen into the molecule. There again the molecule is not soluble, but it will absorb acid materials, and as Dr. Morral has pointed out, on going through this cycle the salts are converted after passing through the first bed into the corresponding acids and the second bed simply removes those acids from the water.

A member: Is that an exchange like the zeolite exchange?

A member: That's right, except that in case of the zeolite exchange you regenerate with salt.

Dr. Morral: In that case, of course, instead of removing all the minerals you have taken out what may be calcium, magnesium, copper, or some other metals like that, and replaced them with sodium to form sodium salts, and they are much more soluble than the calcium ones.

Take a homely example. If you are using soap — provided you can get it these days — fos washing dishes, you lose part of it if you have hard water, and you get a scum left around the dishpan. Now, if you can take calcium and magnesium out of the water by some system like this (and it can be done), you would use that much less soap for washing dishes. And that works similarly, of course, for washing commercial products where you have to watch your costs a little more than you do in the family dish-washing.

Does that straighten that point up? I can't give you the exact chemical formulations of these because I would have to write then clear across the board, even if I knew what they were.

A member: I just wondered what group resins they belonged to, or are there several groups?

Dr. Morral: There are several groups.

A member: To my knowledge the laboratory has worked on several hundred so far, and of course a number of them are more satisfactory than others for one purpose or another. I don't happen to know how many are on the market commercially, do you?

Dr. Morral: No, I don't, but the action is essentially this — this resin, let's say, picks up sodium, and releases hydrogen, another resin absorbs acid. The first is an exchange reaction, and the second is probably an absorption reaction. In the regeneration cycle the first resin picks up hydrogen, and releases the metal ion to the acid; the acid absorbed on the anion resin is released by reaction with the base used to regenerate the resin.

A member: I am not one of those physicists you mentioned, sir, but it seems to me that up until now this discussion has dealt entirely with inorganics. How about organics?

Dr. Morral: As far as I know, organic acids may be absorbed on anion resins.

A member: There again that depends on the nature of the organic material, or what you want to call it. It's both good and bad. Sugar, for example, is non **ionized,** and cannot be removed by a system like this.

A member: Don't they use this in sugar refining?

Dr. Morral: Yes.

A member: I thought you said there wasn't any reaction.

A member: There isn't any reaction with sugar. The reason they use it in sugar refining is this: The solution that they use in sugar refining contains in addition tc the sugar molecules, which they want to keep, some salt, calcium compounds, and so on. Now, commonly, they would evaporate that down and they would get sugar crystals — brown sugar in the first instance — and a black liquid, which, of course, is molasses.

Now, this system can be used to take out the minerals which end up in the molasses. They pass the dilute sugar solution through a resin system such as this. It doesn't take out the sugar because sugar is, as we mentioned, a non-ionized material and is unaffected by these resins, so the sugar goes right on through, but all the calcium and sodium and the other ionized impurities are taken up by these resins, and consequently, their molasses yield is cut way down, which for those of you who like rum is a very sad occurrence, but the sugar manufacturer to whom molasses is a by-product he doesn't particularly want, is very happy to have a resin of this nature to cut his molasses costs down, and of course, increase the amount of sugar he can get out. In the molasses, there is always a certain amount of sugar not recovered. If the molasses proportion can be cut down as it is being done today, by a similar process the amount of sugar recovered will be up. We hope that when enough people get to using these things we will have some sugar.

A member: Is that why molasses tastes like hell now? Is that it?

A member: No. As a matter of fact, at present, this system, as far as the sugar industry goes, is in what you might call a pilot-plant stage. Only a few places are using it.

A member: Does this system remove the odor or color from the water?

Dr. Morral: No. If the color is due to inorganic compound, yes, but the odor, no, except perhaps some by plain filtration .

A member: What will be the advantage of increasing the resistance of the solution if you have a plating bath?

Dr. Morral: That is a very good point. The idea is to remove all your impurities from water that cause trouble in your coating process.

For example, in silver-mirroring, as I mentioned before, if you have any HCL coming in contact with silver you lose silver until you get rid of your HCL, and that causes trouble afterwards. The resistance is just a measurement of the quality of your water.

A member: What I am trying to get at is this. I am thinking of the thing in the wire mill light entirely. The first problem I see is that of steam reduction.

Dr. Morral: You don't need any steam.

A member: I am getting around that. If you wanted to form steam you want water. It is a very good idea to take out calcium and magnesium in order to prevent the formation of boiler scale.

I asked the first question thinking primarily of boilers, and the second question thinking of electro-plating bath, where for our own case, for example, our pH of our incoming water is slightly on the acid side. If we were to make it neutral or pretty close to neutral, which you have in two parts of a million, we should have to add more acid to bring the solution up to pH required.

Dr. Morral: You can add acid to the desired specifications.

A member: I see. That wasn't in the paper.

Dr. Morral: You can have in the plating tanks what you want — what you specified — and not just take what you get.

A member: Then specific resistance brings up the next point. You will increase the specific resistance of the original water.

Dr. Morral: Yes. In your plating bath you put salts in as you specify, and bring it to whatever pH you desire.

A member: You use more salts?

Dr. Morral: Not necessarily. In a steam generator you may not need two parts per million in water, so if you can stand 25 parts, you may pass 50% of your water to the demineralizing unit, and then have 50% by-pass it and let them come together and have your 25 p.p.m. of water. You can make whatever you want by by-passing a certain amount and then blending the two.

A member: Are there any such units in operation?

Dr. Morral: I understand that this is being done.

A member: You mentioned the effect of using this equipment with cyanide baths. Have you ever used it with acid baths, particularly zinc?

Dr. Morral: I galvanized from zinc sulphate, and got much better results with distilled water than tap water, but that was in a region the tap water was loaded with salts.

(Please turn to page 87)

Meeting, Tuesday October 22, 1946 — 10:00 A.M.

L. Atkinson,
Works Manager
Frost Steel & Wire Co., Ltd.,
Hamilton, Canada

Chairman of Meeting

PAPER: The Manufacture of Steel for Basic Rope Wire	by Ralph D. Hindson	The Steel Co., of Canada, Ltd. Hamilton, Canada
PAPER: Some Unusual Conditions Encountered in Cold Heading Products	by F. W. Nobbs, Chief Inspector	The Steel Co. of Canada, Ltd., Toronto, Canada
PAPER: The Application of the Cyclograph to the Non-Destructive Inspection of Materials; in Particular, Rope Wire	by Dr. O. W. Ellis, Director Dept. of Engineering and Metallurgy.	Ontario Research Foundation, Toronto, Canada

PAPER: The Manufacture of Steel for Basic Rope Wire — by Ralph D. Hindson

(Session convened at 9:45 a. m., Mr. L. Atkinson, presiding.)

Secretary Brown: This afternoon will be devoted to an inspection tour of a plant in Tonawanda, and we will go there and back by bus. Incidentally, I am sticking you fellows. We didn't know what the buses were going to cost, and we could have gotten away with charging you a dollar.

I'd like know to introduce the Chairman of this meeting, Mr. L. Atkinson.

Chairman Atkinson: We have a very crowded program this morning, and will get under way without any further delay.

Just one thing—in speaking on papers in the discussion, as outlined yesterday, you may or may not give the name of your firm or yourselves, as you wish, but if you do give your name you will have an opportunity to correct the transcript of the discussion before it is printed, in any event, when it is printed, the discussion will be listed as merely by a member and not by the name of the individual.

The title of our first paper this morning is "The Manufacture of Steel for Basic Rope Wire,", by Mr. Ralph D. Hindson, of The Steel Company of Canada, Ltd. Mr. Hindson!

Mr. Ralph D. Hindson: Mr. Chairman, Members of the American Wire Association: There are probably only two unique features concerning this article that I am going to give you this morning. One is that it was written on the inside of a picket line, and the other is that it was written right beside a never-ending poker game in which the writer was a never-ending contributor—I use the last word advisedly. So, if the expression "two pair" or "flush," turns up, you will perhaps understand and forgive me for it.

There are four general types of speeches, and if Mr. Callaghan is in the house, I'd like to apologize to him for I have already told him this. First, there is a kimono speech, which is long and flowing and not very revealing. Then, there is the corset speech, which takes the middle course but sticks close to the subject. Then, there is the brassiere speech, which is very brief and just touches the high spots. The fourth is the skirt speech which is long enough to cover the subject, but brief enough to be interesting. This morning I am going to try to keep my mind on the third and fourth of these; your mind is probably there already. (Laughter).

(Mr. Ralph D. Hindson, The Steel Company of Canada, Ltd., Hamilton, Canada, then read his paper, "The Manufacture of Steel for Basic Rope Wire.)

Well, gentlemen, this brings me to the end of my script, and before I close, I'd like to read a little verse which I found in the United Engineering Company's magazine, "United Effort," and I think it is particularly apt since some of you are engaged in inspection of metallurgical work, and also since inspection plays such an important role in the manufacture of good steel for wire. It is called "An Inspector's Answer."

"At Satan's gate the inspector stood,
His head bowed in dejection,
And pondered upon his doleful fate,
As he read St. Pete's rejection.

'Your fellow workers,' thus it read,
'Have drawn up this indictment.
You've caused confusion, grief and woe,
And all sorts of excitement.

You tried too hard to please us all,
With rigid, fair inspection.
But nothing made on heaven or earth
Could attain such perfection.

Return to earth, go back to work,
With your mikes and your detectors.
You are not needed up Above,
And hell has no inspectors.'"

Thank you very much for your kind attention. (Applause).

Chairman Atkinson: Thank you very much, Mr. Hindson.

May we have your questions promptly, please? We haven't the same length of time we usually have for questions.

A member: I would like to ask what you would call too high a copper, molybdenum and copper content used for rope wire.

Mr. Hindson: Well, regarding our residual alloy specifications, you meet with the problem that you might have a heat that is maybe one point—when I say that, I mean .01% over the specification. What are you going to do, throw it out for that or not? So you must admit there is a bit of flexibility there before I give you any set figures.

On chromium, .075%. The chromium will not usually be any higher than this because it is oxidized in the open-hearth furnace. Even if you add chromium early in the heat it will come down under .10%.

In nickel, our limit is 10%, molybdenum .05%, tin .025%. Copper would vary pretty closely around—.06%. These residuals, with the exception of chromium, are not oxidized in the furnace; whatever is added you get in your snap.

A member: I have one question I'd like to ask; you refer to it in the rolling process. You try to maintain the temperature for the material at the mill at the high range of heat.

Mr. Hindson: You mean opposite from the way it is in soaking pits?

A member: No.

Mr. Hindson: Generally speaking, we try to keep the temperature at the lower range. Well, actually what I said was this, wasn't it, that in the case of rope wire we tend to aim for the high side of the temperature range—is that what you are referring to—and for softer steels the low side. That's because the roller wishes it that way. It is easier for him to roll the higher-carbon steel at the higher temperature because since high carbon steel spreads more than low-carbon steel, by rolling it at a higher temperature reduces and controls the amount of spread. You know that, and that is why he does it. He finds he can roll his product more accurately to size if he does that. It is just the opposite way you would heat it in soaking pits preparatory to rolling on the bloom mill. The difference is very slight, as you will notice by the range I gave you.

A member: I notice that you are running between 1900 and 2100. Twenty-one hundred is considered pretty high for high-carbon steel. I just wonder if you are trying to aim at the control at the finish.

Mr. Hindson: No, we are not. Our con-

trol isn't perfect on a rod-mill furnace. It is done more by experience of the heaters and by sight, as an old operator usually does it, you know.

We do have pyrometer checks from time to time on the temperature of the material coming out of the furnace, and also the finished rods. I know I have had discussions with our roller on the subject of procedure, and he swears up and down on this method of rolling higher carbon steels. If he holds close to the top temperature, at least that steel is usually heated in the furnace, the heat is handled much easier in his mill, and he went through a lot of explanations. The main one is that high-carbon steel spreads more than low-carbon steel, and cold steel spreads more than hot steel, and so by heating up to a higher temperature on the higher carbon steels he doesn't have as much spread-out through the parting in the rolls. The difference is very slight, but nevertheless important to the roller.

I gave you the two extremes in giving you our heating range of 1900 to 2100°F, so I wouldn't concern myself too much with that difference because it wouldn't be much over 100 degrees.

A member: Some steel mills make steel using no pig iron at all. Would that change your practice very much in making steel?

Mr. Hindson: Yes. Where you use no pig iron — you mean straight scrap?

A member: Open hearth — basic open hearth.

Mr. Hindson: Which one is using straight scrap?

A member: Sheffield Steel.

Mr. Hindson: Well, that would change our practice considerably because American practice is not to use straight scrap. It's usually a percentage, running maybe from 40 up to 70 per cent of hot metal, the balance being scrap, and it would mean quite a change. That would change our lime charge, change the time of heat, additions, etc., and almost everything, for that matter, if we weren't using any hot metal. It would change the whole picture completely.

I don't know of any companies in this continent using straight scrap in the open hearth.

A member: Sheffield Steel of Kansas City, Missouri.

Mr. Hindson: What size furnace?

A member: One-hundred-ton furnaces — four of them, But they do melt the scrap before it goes on, but that has been started lately.

Mr. Hindson: Well, that's a little different, too. It would have to change your practice, of course, but it could be easily adjusted.

Chairman Atkinson: Any further questions, gentlemen?

A member: I would like to ask one question which is bothering us a whole lot. What is a five-rod?

Mr. Hindson: According to our standards, it is .207.

A member: What is a five-rod?

Mr. Hindson: .207 according to our standards.

A member: According to the book, yes, but what is it?

Mr. Hindson: A piece of steel.

A member: I'd like to have people making it tell me what is is.

Mr. Hindson: We roll it, I believe, to 207. Are you driving at the size?

A member: The size we get.

Mr. Hindson: Well, you are allowed 25/1000 out of round, you know.

A member: It's always plus though, never minus.

A member: What are you, buying it or making it?

Chairman Atkinson: I'd like to get into that, too, but I'm afraid we are buying it too.

Gentlemen, I am sorry, but we have to get along. We have two more papers, and it isn't fair to deprive the other gentlemen of this time.

Thank you very much, Mr. Hindson. (Applause).

PAPER: Some Unusual Conditions Encountered in Cold Heading Products — by F. W. Nobbs

Gentlemen, the title of our next paper is "Some Unusual Conditions Encountered in Cold Heading Products", by F. W. Nobbs, Chief Inspector of The Steel Company of Canada, Ltd.

Mr. F. W. Nobbs: Mr. Chairman, Gentlemen: In the past seven years, all of us have been required to do unusual things and we have thus encountered unusual conditions. This paper is an account of some such conditions encountered in practice and is presented with the purpose of passing on practical information to those who are interested in the progress of cold headed products.

(Mr. F. W. Nobbs, Chief Inspector, The Steel Company of Canada, Ltd., Toronto, Canada, then read his paper, "Some Unusual Conditions Encountered in Cold Heading Products.") (Applause).

Chairman Atkinson: Thank you very much.

Gentlemen, the most important part of these meetings is the discussion, but unfortunately our time schedule is such, that I am afraid we will have to dispense with the discussion on this paper, and go on to the next.

We have a plant inspection this afternoon, and will have to get started. I'd like to thank Mr. Nobbs for his kindness in preparing the paper and apologize for not carrying on the discussion.

PAPER: The Application of the Cyclograph to the Non-Destructive Inspection of Materials; in Particular, Wire Rope — by Dr. O. W. Ellis

The third paper this morning in entitled "The Application of the Cyclograph to the Non-Destructive Inspection of Materials; in Particular, Wire Rope," by Dr. O. W. Ellis, Department of Engineering and Metallurgy, Ontario Research Foundation. Dr. Ellis!

Dr. O. W. Ellis: Mr. Atkinson, Gentlemen: Before taking up the subject of my paper, I would like to congratulate Mr. Nobbs on a most interesting paper, and particularly to congratulate him on the ability he showed under certain circumstances of producing very large grains in aluminum alloy.

I myself have recently, in collaboration with Mr. Cavanaugh, whose name I shall be mentioning again shortly, have attempted to produce single crystals for aluminum in test pieces, but so far without any luck at all. When I was with the Westinghouse Company, by some happy chance I did manage with very little difficulty to produce such single crystals in test pieces — about 2" long and about 4.56" diameter, but try as we would at the Foundation, we have been quite unable to reproduce these same results. I will have to approach Mr. Nobbs for information as to how to do it, I can see.

(Dr. O. W. Ellis, Director, Department of Engineering and Metallurgy, Ontario Research Foundation, Toronto, Canada, then read his paper, "The Application of the Cyclograph to the Non-Destructive Inspection of Materials; in Particular, Wire Rope.") (Applause).

Chairman Atkinson: Thank you, Dr. Ellis, for a most interesting paper. It is unfortunate, as I mentioned before, that we have not time to hold the discussion which should have been held on these papers this morning, both for our speakers who have gone to so much trouble in preparing these papers and the members who wish to ask detailed questions.

However, the buses leave in approximately one hour from now, on this inspection tour.

(The session adjourned at 11:50 a. m.)

Written Discussion of the Use of High Frequency Core Losses for Non Destructive Inspection of Wire Rope

by P. E. Cavanagh
Allen B. Dumont Laboratories, Inc. Fellow,
Ontario Research Foundation

SEVERAL attempts have been made in the past to utilize the attractive features of magnetic, non-destructive inspection of wire rope to locate faults and defects in wire rope in service. Indifferent success has been obtained for two major reasons: first, a wire rope is by no means homogeneous with regard to magnetic properties; secondly, different types of defects and normal changes in rope properties during service life give opposite indications in most types of magnetic tests. For instance, broken wires may give a decrease in hysteresis, whereas some types of deformation of metal may give an increase in hysteresis.

* * *

AS **Dr. Ellis** has brought out in his discussion of the high frequency core loss method of inspection, the new feature of this system is that only continuing changes in magnetic properties during service are of significance. The normal variations in readings over the length of a rope which do not change with repeated tests are ignored.

* * *

AN extensive program of investigation has been carried out over the past year and a half with the object of making practical application of this test method to wire rope inspection. Preliminary investigation established that the high frequency method had several advantages. By proper choice of test frequency, the indication obtained for all types of defect was in the same sense. Broken wires, kinks, corrosin, and fatigue damage all gave an increase in core losses with a corresponding decrease in instrument reading. It is also possible to obtain a practically linear correlation between internal stress and instrument reading over a range greater than the normal operating stress range. The ease of providing an automatic record and relay-operated warning signals is also an attractive feature.

* * *

THE first series of experiments established the fact that this method of inspection was applicable to wire rope. A series of field tests next provided data proving that it was possible to use the method in practice with no serious interference with normal hoisting, and that service conditions such as hoisting speed and presence of moisture, grease, and dirt did not interfere with practical application of the instrument.

* * *

FROM the information obtained, it was possible to design an instrument especially for this work. The Du Mont Cable Tester is illustrated in Fig. 1. This instrument was designed particularly for use in mine hoist work. The small (or remote) unit is placed permanently in the head frame, below the sheave. The test coil is wound in place around the rope, not more than fifteen feet from this unit. A special electrical cable in one hundred foot lengths connects the remote unit to the larger main unit, which is placed in the hoist room. A recorder, which is operated by a signal from the main unit, is mechanically driven from the hoist gears so that paper travel is proportional to rope length.

* * *

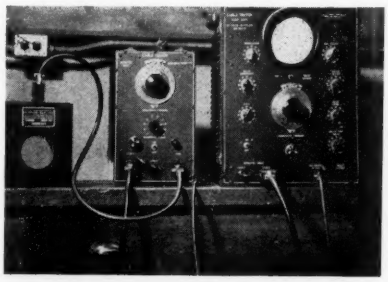

Figure 1

AFTER successful development of this specialized instrument, a series of experiments was carried on to settle many of the fundamental questions which had to be answered before intelligent use could be made of this instrument.

* * *

A great deal of work has been done in the past ten years on the correlation of magnetic properties, stress, and plastic deformation. It was necessary to demonstrate that the Du Mont Cable Tester could successfully detect the beginnings of plastic deformation, whatever the method of bringing about this deformation. Dr. Ellis has discussed some of the fundamental relationships which have been found. Further descriptions may be found in the papers referred to at the end of this article.

* * *

AT present, the situation is that an instrument has been developed which has proven satisfactory for the non-destructive inspection of wire rope. Before serious consideration can be given to putting such an instrument into widespread use, it is necessary to gain considerable experience in its use in the field. It is not possible to inspect a rope which has never been tested before and obtain any useful information. Readings must be repeated on the same rope at intervals with a known load on the rope. An allowable variation from the standard readings for this particular rope must be decided upon. The comparison of charts taken from time to time on the same rope is a simple procedure, since the only significant feature is a continuing change at one location in a rope. It would seem desirable that for the immediate future such inspection should be carried on by highly qualified men.

(*Please turn to page* 88)

Meeting, Wednesday October 23, 1946 — 10:00 A.M.

Kenneth B. Lewis,
Consulting Wire Mill Engineer
Worcester, Mass.

Chairman of Meeting

PAPER: Mill Practice — The Care and Maintenance of Dies	by R. R. Preston, Engineer	The Carboloy Co., Inc., Pitsburgh, Pa.
PAPER: Preparation of Metallographic Specimens	by Freeman G. Anderson, Chief Metallurgist and R. E. McGraw	National Lock Co. Rockford, Ill.
PAPER: Applications of Tin as a Coating Material	by Dr. Bruce W. Gonser	Battelle Memorial Institute Columbus, Ohio

PAPER: Mill Practice — The Care and Maintenance of Dies

by R. R. Preston, Engineer

(The session convened at 10:00 a. m.; Mr. Kenneth Lewis presiding.)

Secretary Brown: Gentlemen, in the absence of Mr. Fraser, we have asked Mr. Kenneth Lewis to act as Chairman. Mr. Fraser hasn't arrived as yet, and if Mr. Fraser arrives later we will have Mr. Lewis step aside and Mr. Fraser will take over.

There seems to be some question as to Mr. Crapo's paper and when it will be presented. The Wire Association has had the Mordica Memorial Lecture (which is the highest honor we can confer), delivered in previous years as part of our regular business sessions, but the Directors thought it wasn't quite dignified enough because it was sandwiched in. So this year, as our luncheon speaker, instead of having a national military speaker or political speaker, we have asked Mr. Crapo to give his paper, and then, in addition to that, due to the addition of the inspection trip we took yesterday afternoon, there is added the showing of the motion picture "Modern Miracles", furnished by the Carboloy Company, and I think you will all enjoy it. We would like to have as many of you as possible at the luncheon because we have been trying to get the Mordica Lecture placed properly, and any cooperation we can get will be appreciated.

I will turn the meeting over now to Mr. Kenneth Lewis, Consulting Wire Engineer who will act as Chairman of this meeting. Mr. Lewis!

Chairman Lewis: This meeting belongs to Jack Fraser, who I was hoping very much would turn up because I used to know him and haven't seen him since the war — I have forgotten which, the Civil, or the first World War. If he comes in, will somebody spot him and have him take his proper place at the table?

The first paper this morning is the paper which was displaced to make room for our inspection trip yesterday. The paper is "Mill Practice — The Care and Maintenance of Dies," by R. R. Preston of the Carboloy Company. Mr. Preston!

(Mr. R. R. Preston, Engineer, The Carboloy Company, Inc., Pittsburgh, Pennsylvania, read his paper, "Mill Practice — The Care and Maintenance of Dies.")

Chairman Lewis: Thank you, Mr. Preston.

The paper is now open for discussion, comment or questions.

A member: Have you any data which would show how many dies a finisher ought to polish in eight hours?

Mr. Preston: Right offhand I don't have such information, but I wonder if Earl Landis is in the audience? Could you answer that, Earl?

A member: I'd say it depends entirely on the condition and size of the dies.

Mr. Preston: That's right.

A member: It's really hard to put it down to a definite figure, as it would be entirely different propositions with different sized dies, and I couldn't give you a definite figure unless we knew the actual size you were going to service.

A member: Let's take an average size we have in rope wire — 050. We try to strike an average for how much a man can do — ought to do that is — and keep him up to that and train him up to do that, and I don't know if we are behind or ahead of other people.

Mr. Preston: How many polishers does he operate?

A member: I am talking about the finished hand-polishers — just one.

Mr. Preston: You are not speaking of the semi-automatic polisher?

A member: No, a finished hand-polisher. He has one machine and does the finishing operation before the ring gets very deep.

Mr Preston: Of course that depends a whole lot upon the operator and the conditions of the dies.

A member: But he has a monthly schedule arrangement, let's say.

Mr. Preston: I know of one plant just recently, for instance, where they are turning out — they have several men in the die room, but are using over 10,000 dies a month. I would not like to make a statement as to the amount, but it doesn't take long to take a ring out.

A member: Have you succeeded in replacing diamond dies on any of the small sizes of stainless where you don't have a coating?

Mr. Preston: There is some of it being done. You mean down to what size?

A member: .012, .014, or .016.

Mr. Preston: Without coating?

A member: There is some of it being done, but I wouldn't say a very large production. Sometimes a few hundred pounds or something like that could get by with it, but without coating on stainless steel, it is down to twelve or something like that, but no finer, I don't think. In some plants I have seen it go down, with coating, down to 006.

A member: That's with your oxide coating. I mean a raw wire.

Chairman Lewis: I'd like to ask an embarrasing question, Mr. Preston.

Mr. Preston: You would.

Chairman Lewis: You mentioned various lime substitutes, and it is a matter which has very much come to the fore in recent years and a matter on which there are divergent opinions. The substitutes for lime, of course, have one great advantage. For the most part they are relatively pure chemicals. They are mostly water-soluble and may be purified by crystallization or by other chemical means. As far as lime is concerned, it is natural, not chemical, and to a large extent you have got to take it as you find it. The substitutes may be sized up by chemical analysis very accurately, whereas with lime there is something further back than chemistry — there are physical characteristics which are very hard to evaluate.

I don't know why I am saying all this, because the question is whether your die people have taken any position with regard to these lime substitutes? Of course coating is a vital matter as far as die-life is concerned, and I understand that you couldn't very well take any public position, but is there a feeling that you sense among the die people — do they feel that the lime substitutes are coming strong, or is there anything you can say without too much embarrassment?

Mr. Preston: Well, I'm a little hard to embarrass anyway, but I will say this. Just as I tried to say in this paper, the whole thing is in the preparing of the stock, and I have known a few cases which had to use lime substitutes, and that is the way it is worked out — by properly preparing a stock they are getting better die life than they got with lime. Now, that is an outstanding case, but I don't think the overall picture is by any means much different.

Chairman Lewis: In other words, the situation is still confused?

Mr. Preston: Definitely, sir.

Chairman Lewis: Thank you.

A member: I just wanted to know how significant a mirror polish of your dies is on the wire produced. Do you get me?

Mr. Preston: How much tonnage per die?

A member: No, what degree of polish is essential on the die.

Mr. Preston: The degree. Explaining

that technically, I don't think I can do it, but most of your polishing of dies is done with what we call No. 5 powder, but it does put on a very high polish.

A member: That is not my question. Suppose you don't have polish, does it affect the quality of the die?

Mr. Preston: By not having a polish?

A member: By not having mirror polish.

Mr. Preston: No. If I understand your question, you want to know what effect it has on the wire drawn if your dies are not polished? Is that right?

A member: Yes.

Mr. Preston: It all depends on what the quality is. If you are drawing something, for instance, like music wire or a high grade of rope or some highly-specialized wire, I think it possibly would hurt you, but with the ordinary run of wire as we most all know, and a large amount of production, I don't think that that would hurt the quality of wire, but it will cut down the life of your die, I believe. Just how much is a question that I think anybody would agree would be very foolish to try to answer because there is such a variable.

Does that answer your question?

A member: That's right.

A member: That would lick you right away — in a few passes.

Mr. Preston: Sure. It just isn't good practice. It isn't common sense not to keep your dies in good condition.

A member: Is there a degree of polish which it is foolish to try to reach?

Mr. Preston: Yes. Now, that is as far as we know it today.

Chairman Lewis: I heard Mr. Gill arguing that with one of the die men before the discussion started. The question is in my mind and has been discussed in the technical press in England several times.

I don't know if there is any standard by which you can evaluate on paper the degree of polish in a die.

Mr. Preston: I think there is, but today it isn't practical for most of the mills, you understand. But in laboratories I think it can be done.

Chairman Lewis: And is it true that when you get beyond a certain reasonable degree of polish you are wasting your time because within the first few hundred feet of wire that polish is gone?

Mr. Preston: Yes, I think that is definite. I think some polish is necessary. I have known places — I have seen plants — where they go way up and use 5 powder, 6 powder, and even 7 powder, but what they were doing was putting out a beautiful die, and I am sure it wasn't worth the effort and the expense for doing all that.

Chairman Lewis: One of the difficulties of research — laboratory research — in this specialty of ours is that it is generally done with a few feet of wire and there have been some remarkable results obtained in the way of low die pulls by using dies of extremely high polish. It's pretty certain that if they went to two or three hundred feet of wire those results would evaporate.

Mr. Preston: And when you do that you are usually running at slow speed.

Chairman Lewis: Right you are.

Mr. Preston: In my opinion, the die life depends on the preparation of your stock, the hardness of the wire, and the speed at which you are operating.

Chairman Lewis: Well, is it safe to say that for each set of mill conditions there is a degree of polish to which it is worthwhile to aspire, and beyond which it is foolish to go?

Mr. Preston: Definitely so. I have known of cases where, in my opinion, they weren't doing too good a job on their dies, but they were doing an excellent job in the cleaning house with an acid practice of five or ten pounds per ton more than a similar plant would do, and they were getting good die life.

Chairman Lewis: Is there any practical way to designate the degree of polish in a die — I just heard you speak of various grades of powder.

Mr. Preston: No. I think just an eyeloop or something like that is perfectly good enough and unless you are using something for laboratory work. But for a wire mill die room, an eyeloop is perfectly sufficient to observe the polish and so forth — that is, that you have in the die and that is necessary.

Chairman Lewis: Well, the degree of polish is a rather vague thing.

Mr. Preston: I think it gets a little complicated because it gets into where you might say "What size wire are you drawing?" and "What is your speed?" and "What is the kind of wire" and all that. If it is just single-hole wire (which you probably don't mean) — do you mean something in the finer sizes?

Chairman Lewis: Yes. I am not speaking of special finishes or extra brights, but just the ordinary run of wire run chiefly for the purpose of reducing the size.

Mr. Preston: I think the principal thing is not that you want a good polish, but I think the principal thing is getting your dies to your die room as we tried to show here. Be sure that the ring that forms doesn't get too deep before it is removed. I think that is important, and putting a fairly good polish on.

A member: I don't know whether I should say this, but listening to the conversation, the main thing is to get the die free from rings or scratches. We have had some cases where a high degree of polish has helped, but generally speaking, you get that die smooth and free from rings and scratches.

Chairman Lewis: We are getting bogged down here in a mess of definitions. What is polish if it isn't freedom from rings and scratches?

A member: You are going way on beyond that. I'd say, visible to the eye with a 7-power loop.

Chairman Lewis: That is what I am groping for — to see if there is some kind of a standard that could be set up for polishing.

Mr. Preston: I have seen many dies that had a beautiful polish that didn't amount to anything because the polish was covering a scratch or a wear ring. You can put a beautiful polish over that, and it still doesn't mean anything unless you have a good surface to polish.

Chairman Lewis: Of course you can put a good polish on a lousy shape, and that goes for more than dies.

Mr. Preston: True.

Chairman Lewis: Any further questions?

Mr. Lewis: When a die wears, does it wear by the breaking up or rubbing away of the carbide, the particles coming out?

Mr. Preston: Small particles of your carbide breaking away — it's a wearing out. You are just wearing off your small particles. Isn't that right, Mr. Green?

A member: That's correct.

Mr. Lewis: In that case then, the die manufacturers have a problem in cementing those carbide particles together so they don't pull out, and that perhaps is the major problem rather than the high polish. Is that true?

Mr. Preston: It definitely is. In the slide we showed on the tungsten carbide there, I believe that that was about a 500,000 magnification there, so you see it's a very fine job.

Chairman Lewis: Wait a minute! What magnification?

Mr. Preston: What about that, Earl? What was the magnification of that?

A member: Fifteen hundred, but when you saw it on the screen, about 5,000.

Mr. Preston: That's right. I got my figures mixed up.

A member: Mr. Preston spoke of low carbon and high carbon, but didn't say anything about copper or brass. What effect would it have at 6,000 on non-ferrous material?

Mr. Preston: At those speeds most people are using diamond dies. As far as I know, the large copper people are drawing those sizes with diamond dies. That is what I wanted to bring out. There has been a question of where to break off from your carbide to your diamond.

A member: But in your basic material they are going down to 006. Some draw to 005 in carbide. Do you on copper and brass?

Mr. Preston: No.

A member: These remarks the last few minutes have been along the lines of a question I have. There has been some thinking out loud, I think, for the past few months on this matter of finishes that I have heard about. I don't know a thing about it, but that was the matter of leaving a sort of a mat finish in the die as against highly-polished mirror finish.

The theory there, as it was told me — the mat finish would entrap lubricant within the die and prolong the die life.

Now, Mr. Preston, since you are not easily embarrassed, may I suggest that we have a few words from James Longwell of a more technical fashion on this matter of high polishes.

Mr. Preston: I think that would be very nice.

Mr. James Longwell: I would like to say a word or two. Your cemented material of which your carbide die is made up is principally of particles in the neighborhood of one millionth inch in diameter, and by far the largest proportion in that category are less than five millionths in maximum size.

If you are going to finish this material you have got a problem to look out for in that you want the carbide to have a smooth surface so that the occurrence of friction is reduced to a minimum. The cobalt binder holds these particles together. It's a soft material, and if in the so-called polishing of the die you are not careful, you smear the cobalt over the carbide and get a very beautiful finish, but one which does not last long in the mill — nowhere near as long as where you have polished the carbide and not smeared the cobalt.

It's not unusual at all to see dies with a high-mirror finish in which you take a pull of maybe one bundle, and look in it and see a lot of deep scratches and you

(*Continued on page* 91)

(Mr. Freeman G. Anderson, Chief Metallurgist of National Lock Company, Rockford, Illinois, read his paper, "Preparation of Metallographic Specimens.")

Chairman Lewis: Thank you very much, Mr. Anderson. Strange as it may seem, I was very much interested in your paper.

Mr. Anderson: Thank you.

Chairman Lewis: You may not know I was one of the very early metallographists. At a time when most members were playing marbles, I was one of the very small band of lunatics who were studying the new science of metallography. In 1904, I knew all there was to know about metallography, but I haven't learned anything since.

I left college and went into the practical side of steel manufacture and I found it necessary to close my mind as far as metallography was concerned, because metallographists were just a bad smell in the steel plants.

We used to polish specimens, as I recall, first with coarse emery and then fine emery, and then tripoli, and then rouge. Well, since then methods have changed somewhat I gather, but one thing I want to inquire — has any way been found to prevent the specimen from leaping out of your fingers and hitting the roof?

Mr. Anderson: That happens today.

Chairman Lewis: Do you still have to hold the specimen in your fingers?

Mr. Anderson: Yes. It is still a critical thing. The metallographist has to have a knowledge of true structures. He must know, for instance, when the flowed metal or disturbed metal has been removed and he must be able to recognize inclusions when they are there or know a true structure from a false structure, but actually, this method does not require any tricks particularly, I would say. The weight of the sample on the wheels is sufficient, and—

Chairman Lewis: You mean that the wheels are on a vertical axle?

Mr. Anderson: No, they are on a horizontal.

Chairman Lewis: Then, how does the weight of the sample figure?

Mr. Anderson: The horizontal wheel on a vertical spindle.

With a vertical wheel it's very difficult to keep your abrasives on or to apply the abrasives.

Chairman Lewis: We used to find most of the abrasive on the front of our shirt at the end of the operation.

Mr. Anderson: I didn't go into the matter of polishing equipment — that is, the stands themselves. I didn't want to do any advertising, but there are some now that are available and are motorized, that do the job very satisfactorily, but I didn't think that was a matter worthy of mention.

A member: Can you suggest something to hold very fine wire to keep the edges sharp.

Mr. Anderson: Yes, I think we, in this method, invariably mount the specimens. We do not ever hold the specimen itself unless it is a very large one, or unless we don't care about the edges. Where we want to examine the entire specimen and examine the edges, we always mount them in either lucite or bakelite.

A member: But is that not liable to stain the specimen especially in fine wires?

Mr. Anderson: No, we don't find that it does — not lucite and not bakelite. Bakelite will if it is not properly cured; lucite doesn't either unless you have polished and repolished it a lot of times and cracked it. It can crack from the alcohol and ether. Stain is a different problem.

Other than that, we find that if you will use alcohol that has been double-distilled to remove all moisture, you will have much less trouble; and then apply it not by dunking it, but to actually drop it on from a dropper, and keep it in motion. As soon as the time is up, wash it off from another bottle with alcohol, and as soon as you have done that, rinse that off. It only takes probably two or three cc's to do it, then you use ether and make sure your ether is dry. Don't allow it to be exposed to air at any time — keep it in your bottle, closed, and by keeping those things free from moisture you wouldn't have so much trouble with stains. I find that picric acid has water in it in itself and adding it to alcohol you tend to get some stains, but we don't have a problem at all, even though we do use lucite and bakelite.

A member: Between each of your operations, do you rinse it off?

Mr. Anderson: Yes, we do wash them off. For a long time we were very carefull to wash our hands too, and even our fingernails, but in this method it isn't as bad as we expected because in the final polish — the one in which you want to get the scratches entirely eliminated — we were trying to find all possibilities, and as a result took this gamal cloth and added some 600 right onto it to see just what we would get. It's amazing to see the few scratches we got. It behaved quite similarly to the regular diamond abrasive, so that it is necessary, we think, to wash it off, particularly after the paraffin wheel. We don't like to transfer any paraffin on the final cloth.

A member: Then our final rinse, do I understand you to say, you just use alcohol and no water at all when you are coming off your cloth after your final operation? You rinse off with alcohol only and no water?

Mr. Anderson: You can rinse it off with water and wipe it dry and then alcohol.

A member: Do you wipe it, or dry it with a blower?

Mr. Anderson: We wipe it, but I would say what would be best in all cases — particularly if you were trying to study zinc coatings or galvanized coatings or something like that and you were working with close pH controlled braces, that you better not do that. You'd rinse it off with distilled water without any drying, and put alcohol or a hot-blast — probably blow it right off quickly without any drying or wiping it off.

Mr. Lewis: Mr. Anderson, has your paper been published or is it going to be published?

Mr. Anderson: I understand it will be published in the November issue of Wire and Wire Products. They didn't have enough paper, I understand, to publish all the papers in this issue.

Chairman Lewis: Wil you straighten me out, Mr. Anderson, on this paraffin wheel? That is new to me. Is that merely a carrier to be impregnated by some sort of abrasive?

Mr. Anderson: Yes, it is a carrier, and it does become impregnated on the tops of these projections. They have become impregnated with a 600 grit.

A member: I'd like to know if you have any breaking in to do on this kind of wheel like you would on a rouge?

Mr. Anderson: That's a very good question. No, there isn't. One of the advantages of the gamal cloth is that it starts right in. You merely wet it for the first sample on the wheel just as you would on the tenth or the twentieth, and it is long-lasting. Probably the shortest-life wheel is the paraffin wheel itself — that is, until it needs reconditioning, but reconditioning is simply a matter of melting it down and letting it resolidify, and you can do that at the end of the day.

If you have a lot of samples to prepare — hundreds per day — you may have to have a half a dozen of these paraffin wheels and have them all ready for use so that during the course of the day you wouldn't be shut down for a lack of a paraffin wheel that is in good condition.

A member: Evidently not too many know about this wax wheel. I did have a little experience with it when at Keystone, and the remelting. Your abrasive that is impregnated drops to the bottom and when you get ready to change your wheel, just melt it out ,and all your excess abrasive has gone down on the bottom. You reimpregnate it again when you start up again.

Mr. Anderson: That's right. It isn't good to do that too much. We do scrape off the top layer of the abrasive rather quickly. We don't try to get it all because if there is any left there it does sink down. We don't like to leave it and let it all sink down because you finally develop a layer on the bottom that doesn't attach itself to the disk.

A member: What is the advantage of the cross-section lead or soldered lap and paraffin lap as compared to the spiral?

Mr. Anderson: We didn't like the spiral. It seems to give too much flat surface. We like to have that broken up so that there are places for the loose abrasives to go to when they are lumped together, I guess. We don't like a large area of flat surface. It just doesn't work. I don't know the exact explanation.

A member: We tried the cross-section. I haven't done too much with it, but our opinion was in the spiral form the lubricant tended, even though it went to the outside, to follow that spiral, and then it would go back over the wheel again causing less use of abrasive, for instance. I wanted your opinion.

Mr. Anderson: Well, abrasive is very cheap. I don't know that you can't well afford to use abrasive quite abundantly as compared to the expense you would have now on paper. Paper is expensive, and the cost of abrasive (I don't remember exactly), is probably about a dollar a pound, and you would get literally hundreds of samples from a pound of abrasive. The cost is a minor detail there. It would be a small thing to try to use it over again or worry about the loss of the wheel.

Chairman Lewis: I could talk with you a long time, and be interested all the time on this subject, but I think we ought to devote what little time we have to intelligent questions.

Are there any more from the floor? (Silence).

Then I want to thank you, Mr. Anderson, for this paper. (Applause).

PAPER: Applications of Tin as a Coating Material — by Dr. Bruce W. Gonser

We will now hear from Dr. Gonser on the application of tin as a coating material.

Dr. Bruce W. Gonser: Gentlemen: The subject of coatings is an interesting one, and I wish we really had more time to cover the many phases of it. As it is, I plan only to outline some of the general methods that tin coatings can be applied particularly in wire industry and wire products with the hope that this discussion will bring out something of particular importance to you.

I am not an expert on tinning wire by any means. My interest is largely in trying to stimulate you in thinking of other means and of other tools that are available in obtaining coatings.

(Dr. Bruce W. Gonser, Batelle Memorial Institute, Columbus, Ohio, read his paper, "Applications of Tin as a Coating Material.")

Chairman Lewis: Thank you very much, Doctor. That, I think, is the most concentrated dose of pure information that this Association has listened to for a long time. What we should have done was to put you under contract for five years and let you break that up into five lectures.

One question ocurred to me as you went along. You spoke of electro-plating alloys such as tin; in other words, by impressing different electrical systems onto separate sets of electrodes. I was connected with an experiment of that sort a few years ago and I wonder if you found what we found, that when you increase the number of metals in an electro-plated alloy of that sort, the density of the deposit increases enormously. We found that two metals were not twice as dense as one. There was, oh, maybe seven or eight times the density as compared with a single coat of the same thickness and then when you went to three, the density increased terrifically. It seemed to go up in some sort of logarythmic ratio. Have you found that?

Dr. Gonser: I can't say we have. It's a very interesting observation. I'm glad you mentioned it.

Chairman Lewis: I won't take up more time. We are short on it. I got hell last year for letting the Wednesday meeting run over, and I am not going to stick my neck out again. We have twelve minutes for questions.

A member: Mr. Chairman, I'd like to ask Dr. Gonser what he considers to be the best substitute for tin in coating fine wire for stitching and stapling wire. As far as we can see, tin seems to give the best lubricating properties in machines for cutting up staples, and we have been doing some amount of work on different substitutes for tin. Tin is not released in Canada today for use right now. It is restricted.

Dr. Gonser: I think you are right, tin is the best by far. It is only when you absolutely can't get it that a substitute would be considered. During the war, even though we were trying our best to hold the consumption of tin to a minimum, it was allowed for fine copper work right along. Where substitutes were used, there are a number of them.

I would say there are a list of eight or nine substitutes that we could give you. For instance, Anaconda used one which contains a little cadmium as well as tin. There is one containing Amaloy which of course runs up to ten per cent tin, with lead and phosphorus. There are a number of tin leads which will contain two or three per cent tin and maybe one per cent Amaloy. I would not be in a position to tell you what would be the best one.

Chairman Lewis: Is there any substitute for tin that isn't scarcer than tin?

Dr. Gonser: That's a good question. Lead is just about as scarce, isn't it?

Chairman Lewis: I have been around trying to buy some lead, that's why I asked.

Dr. Gonser: I know there is more lead, but I don't know if its available or not.

Chairman Lewis: I can't see the point in finding a substitute for tin; you use such a small amount of it. The only excuse is you can't get tin; and can you get a substitute?

Dr. Gonser: That's the question of the day, and I think a great many people have that problem.

A member: I have heard that the zinc cadmium mixture is a suitable substitute. We haven't actually tried it out yet.

Dr. Gonser: This is on steel wire?
A member: Yes.

Dr. Gonser: That is very good. The only thing is, can you get it?

A member: I think we can get it easier than tin.

Dr. Gonser: I had sort of eliminated cadmium as it is harder to get than tin.

Chairman Lewis: Would that be the 70/30 alloy?

Dr. Gonser: That would be the preferred one, I should think, because of the ease of handling.

I think about I might make one comment about the tin situation now. Far be it from me to tell you that tin is easing up, but certainly the trend is in that direction. You will notice how the stocks in this country had been used up right along and now here this year they are starting to be levelling. Now, in fact, there are a couple of thousand tons more available than at the beginning of the year. World production is increasing — Malaya is coming back into the market. It takes time, it isn't a case of getting dredges, it is a case of getting people's homes built up and getting supplies and goods available and chances are it will be 1949 before we will have all we need.

Chairman Lewis: Just so you don't make it '59.

A member: I'd like to ask the Doctor if you can deposit bronze from a molten solution by the substitution process.

Dr. Gonser: You can deposit bronze particularly from molten salts. In fact, you can't help it. That is what you get — a tin copper alloy. Your temperature is high, but molten tin will not stay pure tin for a great length of time at all, but fuses right in the copper and your coating is copper-tin compound. That is what you get.

Mr. Lewis: I am thinking of a yellow bronze.

Dr. Gonser: Is this on copper or on steel?

Mr. Lewis: On steel.

Dr. Gonser: Yes, there you can get it very easily by depositing a little copper on the steel or doing as I mentioned, using a solution which has both copper and tin in it. Then, your copper tends to come out on the steel.

Mr. Lewis: I mean the molten.

Dr. Gonser: Your temperature is high enough there. I don't know, you might. We have never tried it. As far as I know, we are the only ones that have ever worked on the molten salt and we have never tried to put bronze on.

Mr. Lewis: Can you put tin on steel from molten salts?

Dr. Gonser: That's right. Very readily. It gives a very nice, bright coating.

Chairman Lewis: What sort of thickness of coating?

Dr. Gonser: It depends entirely on the temperature and concentration. It will run up in a couple of minutes' immersion, and you will get as much tin on as you will get on electro-tinplating.

Chairman Lewis: What would a longer immersion do — give you a thicker coating?

Dr. Gonser: Yes. If you try to get too much on, it becomes more glandular — you don't get that nice, bright coating that you want, but it is quite continuous.

Chairman Lewis: Any more questions? I expect that unless you hurry out the back way you will be mobbed after this session as you have thrown open so many matters for argument.

Dr. Gonser: I'd be very glad to talk with anyone.

Chairman Lewis: Then, if I hear nothing more, I am going to make an announcement. Mr. Brown asked me to say that regarding the supper and smoker tonight, the hotel has required him to report definitely the number to be present by three o'clock this afternoon. Therefore, if you haven't gotten your ticket and intend to go, buy your ticket before three o'clock.

I am going to close this meeting five minutes early, and I hope I get myself a little credit on last year's meeting.

(The session adjourned at 12:25 p. m.)

Meeting, Thursday October 24, 1946 — 10:00 A.M.

George A. Fowles,
Sales Manager, Thermoplastic Div.,
The B. F. Goodrich Chemical Co.
Cleveland, Ohio

Chairman of Meeting

PAPER: Aluminum Wire Fabrication	by H. S. Spaulding This paper presented by W. E. King Chief Metallurgist	Aluminum Company of America Massena Works, Aluminum Company of America
PAPER: Synthetics for Wire and Cable	by H. B. Slade Electrical Research Engineer	The Okonite Company Passaic, N. J.
PAPER: Some Observations on Manufacturing Insulated Wire In Wartime Germany and The United States	by R. A. Schatzel, Vice President and Director of Engineering	Rome Cable Corporation Rome, N. Y.

PAPER: Aluminum Wire Fabrication — **by H. S. Spaulding**

(The session convened at 10:10 a. m. Chairman George A. Fowles presiding.)

Secretary Brown: Can I have your attention, gentlemen, please?

It gives me great pleasure to present the Chairman of the meeting this morning, Mr. George A. Fowles, Sales Manager of the Thermoplastic Division of the B. F. Goodrich Company. Mr. Fowles!

Chairman Fowles: Thank you, Mr. Brown. The last time I had the pleasure of being with this group was two years ago. Since that time, the country has undergone some serious changes. We are quite fortunate today in having with us a group of leaders in the wire and cable industry, who represent the combination of leadership which helped us through the war and is going to help us tremendously in this postwar period.

During the war, as you know, aluminum and synthetic insulatives played a tremendous part in the insulated wire industry, particularly in the Navy battleship cables. Today, I think there is an important part to be played by aluminum and plastics and synthetics in the insulated wire and cable field.

You probably have seen recent announcements of cable companies of a program of aluminum wire for house and building wire.

Two years ago, when we were in the midst of the war, we were fighting priorities, allocations and WPB. Today we have a few priorities left, we have a hundred thousand allocation problems, and we are still having trouble with Washington. Since that time, the insulated wire field has changed from the war wire field to the postwar wire field, which is at present predominantly a building wire program.

In the changing picture there are incidently some amusing types of insulated wire that have been developed. I happen to know of an instance that came to our attention in the last few weeks wherein an insulated wire is being used to support some of those things that you saw last night. More specifically a plastic insulated wire is being used as a foundation for some of the modern strapless brassieres.

Without attempting to go into any more of these interesting applications, I'd like to introduce the first speaker on the program. I might explain that Mr. Spaulding, who wrote the paper to be given has since left the Aluminum Company, and therefore did not feel he should present the paper. As an excellent alternative, Mr. King, who is Chief Metallurgist at the Massena plant of the Aluminum Company of America, Fabricating Division, is here to present that paper.

Mr. King is a graduate of MIT. He has been working with the Aluminum Company ever since his graduation, for seventeen years. He has the experience and background that well qualifies him to tell us about fabricating aluminum wire. Mr. King!

(Mr. W. E. King, Chief Metallurgist, Massena Works, Aluminum Company of America, read the paper, "Aluminum Wire Fabrication," which was prepared by Mr. H. S. Spaulding, former employee of the Aluminum Company of America.)

Chairman Fowles: If there are any questions, I am sure Mr. King will be pleased to answer them.

When you ask the questions, please give your name. I assure you you will not be misquoted or quoted to your disadvantage in the publication of these questions which will appear later.

Are there any questions?

I'd like to ask you, Mr. King, if the problem of salt corrosion has been satisfactorily answered on this screen wire.

Mr. King: Well, in what respect do you mean? In coastal applications?

Chairman Fowles: Yes.

Mr. King: Aluminum screen wire is protected, as Mr. Spaulding has stated in his article, with a higher purity coating alloy, one that electrolytically protects the core, but its application on the sea coast is not as satisfactory as it would be in the interior. Aluminum alloys in general are more resistant to normal atmospheres than they are to salt water atmospheres.

I might add from experiments in which test samples of screen cloth made from various alloys such as copper, bronze, steel, Alclad aluminum, etc. have been exposed to salt water atmospheres, it has been shown that Alclad aluminum screen cloth stands up better than the other alloys.

A member: I don't know whether or not this is extraneous, but can you tell us something of the rolling of the rod? Nothing of that has been mentioned in the paper.

Mr. King: Yes. At Massena we have a 38" Blooming Mill where we take the ingots, generally about 12" x 12" in crossection, and roll them down to about a 6" x 6" bloom size. Then the blooms are conditioned if necessary and finish rolled on our new 12" Continuous Rod Mill which we recently installed at Massena. On this mill the aluminum is rolled from 6" x 6" to a 3/8" diameter rolled rod in one operation.

A member: How many passes?

Mr. King: Well, the mill has twenty-two stands, but we generally use about twenty stands in breaking it down from 6" x 6" to 3/8" diameter rod.

Does that answer your question?

A member: Yes.

A member: I'd like to ask a question. Is your screen-cloth wire handled in a composite manner when rolling, or is the outer alloy applied before rolling?

Mr. King: We cast the molten coating alloy onto a rolled core in a 6" x 6" mold, and then enter this composite billet into the 12" Continuous Mill and roll it down to 3/8" diameter rod.

Chairman Fowles: Are there any further questions?

A member: Does the aluminum rod need cleaning as it goes along?

Mr. King: No. As Mr. Spaulding pointed out in his article, that is one of the big advantages of aluminum. It is not necessary to give the surface of the rod any treatment at all. We merely take the rod, anneal it if necessary and then draw it down in a wire drawing machine. There is no other intermediate treatment necessary between rolling and wire drawing. That is one of the big advantages of aluminum, I think, as compared to some of the other metals.

A member: Have you ever experienced any excessive die wear on the first draft due to the outside coat, or any other cause?

Mr. King: No, we haven't. We do not find that the wear on that first die is any more excessive than any of the others.

(*Please turn to page* 92)

It seems an excellent idea to have following the paper on aluminum a paper by a company that has spent much time and effort in studying the synthetic insulating materials.

I know that in 1935, the company that is next represented spent a great deal of effort in putting across the idea of a plastic insulation on wire and cable with the Navy. Prior to that, they'd spent much time on neoprene — that is a jacking material for Navy cables.

Representing that company we have a man who has spent the last ten years with them, concentrating on the electrical and associated problems in insulating synthetic materials. He is a graduate of Harvard. He has been with the Okonite Company for the past ten years, since 1936 — Mr. Harry Slade!

(Mr. H. B. Slade, Electrical Research Engineer, The Okonite Company, Passaic, New Jersey, read his paper, "Synthetics for Wire and Cable.")

Chairman Fowles: Are there any questions you'd like to ask Mr. Slade?

A member: Have you had any experience with the use of carbon black in connection with these resins, to improve the insulating properties of those resins?

Mr. Slade: It has a peculiar effect on some of them, in the vinyls, carbon black sometimes steps its properties up out of all proportion to the amount used. Insulation resistance sometimes increases by leaps and bounds, but I don't think you would use that as an argument to say that black is better than the colors.

A member: I might tell you something which I learned a few weeks ago which might be of some interest.

An experiment was conducted by one of the large cable companies, and they found that more than or less than one-half of one per cent of a particular compound made the difference of whether you had good or bad insulating properties. It's as critical as that. That's one-half of one per cent in the finished resin combination.

Mr. Slade: Well, early in the game there were compounds made with as much as five per cent, which are even patented by the GE company, and it didn't seem to make much difference whether it was five or two per cent on that compound. We never used that much. We have kept around one per cent or less, but I didn't realize it was any borderline case such as you mention.

Chairman Fowles: I may be out of order, but I would like to add the comment that one per cent seems to be a good percentage in vinyl compounding. We have been using approximately that percentage for about five years.

Are there any other questions?

Mr. Slade has mentioned a great number of materials, which you may have seen in one form or the other. As a raw-material supplier, I'd like to add the additional comment that I believe you will see many more new materials in the next two years on wire and cable. There are many in the research laboratories of today that haven't yet been released. You will particularly find combinations of materials that will tend to change cable constructions more radically, probably, than they have changed in the past.

I am sure we all thank Mr. Slade. If you have any further comments or questions he will be glad to answer them afterwards. (Applause).

PAPER: Some observations on Manufacturing Insulated Wire in Wartime Germany and The United States — by R. A. Schatzel, Vice President and Director of Engineering

As an excellent anchor man on this morning's team, we were quite fortunate in being able to obtain a man who has had many years of experience and has seen most of the significant developments made on insulated wire and cable. He is now Vice President and Director of Engineering of the Rome Cable Corporation. He was formerly Director of Research of the General Cable Corporation. Throughout the war he served as Chairman of the WPB consulting Technical Committee. He has been Chairman of the ASTM Sub-committee V of Committee D11, on Wire and Cables, for the last ten years, and was also Chairman of an ASA Committee.

I think that if we could point to any man and say that that man enabled us to use GRS quickly, when we had to change quickly during the war, we would all point to Mr. Schatzel. Mr. Schatzel!

Mr. R. A. Schatzel: Mr. Chairman, Members of the Wire Association: I am pleased to be able to come here this morning and give you some little report on the miscellaneous things that we saw last year in Germany, directly after the war, and in the limited time that we have. I think that I will stick mostly to that and let me say that I know that my voice doesn't carry very far, but if those in the back row can't hear me just let me know.

Most of the observations that we made in Germany as representatives of this Government, were confined to synthetic rubber — synthetic rubber manufacture, and synthetic rubber use.

(Mr. R. A. Schatzel, Vice President and Director of Engineering, Rome Cable Corporation, Rome, New York, then read his paper, "Some Observations on Manufacturing Insulated Wire in Wartime Germany and the United States." (Applause).

Chairman Fowles: I am sure we all appreciate this most excellent picture of a wire plant in Germany, and particularly appreciate the comparison between their operations and ours.

Are there any questions you would like to ask Mr. Schatzel now?

I know there are thousands of questions we could ask him, but the time is short, and you probably are ready for lunch.

If there are no questions, then the meeting stands adjourned.

(The session adjourned at 12:15 p. m.)

A THOUGHT

ADVERTISING is a service to a magazine's readers. Methods, materials, and machinery are developing continually. Both editorial matter and advertisements keep you informed on what is happening in industry.

Meeting, Thursday, October 24, 1946 — 2:00 P.M.

H. B. Carnahan,
Asst. Works Mgr.
Canada Wire & Cable Co., Ltd.
Toronto, Canada

Chairman of Meeting

PAPER: Synthetic Insulants in the Cable Industry	by D. Short Electrical Engineer	Canada Wire & Cable Co., Ltd., Toronto, Canada
PAPER: Application of Fiberglas to Wire and Cable	By Fred F. Sampson, Jr. In Charge of Wire and Cable Section, Insulated Wire Division	Owens-Corning Fiberglas Corp., Toledo, Ohio

PAPER: Synthetic Insulants in the Cable Industry — by D. Short.

(The Final Session of the Wire Association Technical Convention convened at 2:00 o'clock. Mr. H. B. Carnahan presiding.)

Secretary Brown: Gentlemen, this session this afternoon is on synthetic and glass insulations, and it gives me great pleasure to introduce the Chairman of the meeting, Mr. H. B. Carnahan, Assistant Works Manager of the Canada Wire & Cable Co., Ltd.

Chairman Carnahan: I regret we are late getting started. As most of you know, we didn't finish the morning session until after twelve o'clock, and there are a lot of boys still in the dining room, but the program this afternoon includes papers followed by a movie, and I think it is well if we went on and introduced our first speaker, Mr. Doug Short, whose paper is "Synthetic Insulants in the Cable Industry." Mr. Short!

Mr. D. Short: Mr. Chairman and Gentlemen: It is not without some anxiety that I rise to this occasion. Nonetheless, I appreciate the privilege of preparing a paper for presentation to your Association, and I would thank your Executive Secretary for extending the invitation on behalf of the firm with which I am connected and myself personally.

I must, indeed I feel somewhat obligated, to say at the outset that by no elastic phenomena of one's imagination can it be said I am an expert in the chemistry of plastics. However, with your indulgence, I propose to deal with some salient features of insulations, dialectrics or insulants if you wish, and of the applications of some synthetic plastic varieties in respect to the field of cable-making.

(Mr. D. Short, Electrical Engineer, Canade Wire & Cable Co., Ltd., Canada, then read his paper, "Synthetic Insulants in the Cable Industry.") (Applause).

Chairman Carnahan: Thank you, Mr. Short.

Gentlemen, I think we have had some excellent papers to date. Mr. Short's paper was taken on the manufacturing part of synthetics — past, present and future — and if anybody has any questions they'd like to ask, Mr. Short will be glad to have them now.

PAPER: Applications of Fiberglas to Wire and Cable — by Fred F. Sampson, Jr.

If not, we will move right along to Mr. Sampson's paper on the "Applications ot Fiberglas to Wire and Cable."

I believe that Mr. Sampson has a couple of samples up here, and I wonder if it would be all right to have them reviewed after the motion picture which follows his paper.

Without any further ado, I will call on Mr. Fred Sampson, In Charge of Wire and Cable Section, Insulated Wire Division, Owens-Corning Fiberglas Corporation.

Mr. Fred F. Sampson, Jr.: Mr. Chairman and Gentlemen: This is not a technical paper in any respect, but is merely intended to acquaint you with the more recent developments of the applications of fiberglas products in the wire and cable industry.

(Mr. Fred F. Sampson, Jr., In Charge of Wire and Cable Section, Insulated Wire Division, Owens-Corning Fiberglas Corporation, Toledo, Ohio, then read his paper, "Applications of Fiberglas to Wire and Cable.")

Chairman Carnahan: Thank you, Mr. Sampson.

Gentlemen, have you any questions you would like to ask Mr. Sampson on Fiberglas?

I have one. Is the dye used in the making of this identification glass yarn permanent under steam vulcanization?

Mr. Sampson: That was the purpose of the laboratory test we mentioned in this talk, and in the test conducted by that particular company, it was indicated that the material would withstand that.

A member: I was wondering what solvents that would withstand. Will it withstand fading?

Mr. Sampson: That is kind of a tough question to answer, and the reason is because we, at the moment, are working on two different processes for making fiberglas-dyed yarn. One dyed yarn is more resistant to certain solvents than the other. Are you interested in a particular solvent?

A member: No. The only thing that occurs to me is I was given a sample sometime ago of a blue yarn. I find that after handling it and letting it stay around that it seems to fade out.

Mr. Sampson: How long ago was that?

A member: Seven or eight months ago.

Mr. Sampson: I think you would find that you would not have that experience now.

Chairman Carnahan: Are there any other questions, gentlemen?

If not, we will go right on with the movie.

We have a motion picture, gentlemen, on Noranda Enterprises that I think you gentlemen will enjoy.

(The motion picture, "Noranda Enterprises," was then shown.) (Applause).

Chairman Carnahan: Gentlemen, I hope that you found the film somewhat interesting. We are not overly-proud of it I might say. It is several years old, and we hope to have one in color that will be somewhat more interesting. However, there is some constructive thought there for people who have not seen mining operations.

Gentlemen, this now concludes the meetings of the Wire Association, and I understand Room 1016 is ours until midnight tonight, and the bar will be open until then.

(The convention adjourned sine die at 3:30 p. m.)

1946 Wire Association Convention Attendance List

ABRAMS, J. H., Jr., Serv. Engr.
American Chemical Paint Company
Ambler, Penna.

AIKEN, JOHN C., Works Mgr.
Steel Company of Canada, Ltd.
Canada Works
Hamilton, Ont., Canada

ALLEN, A. J., Asst. Carbide Prod. Mgr.
Firth Sterling Steel Company
McKeesport, Penna.

ANDERSON, FREEMAN G., Met.
National Lock Company
Rockford, Illinois

ANJESKEY, A. F., Sales Mgr.
Cleveland Tramrail Division
Cleveland Crane & Engr. Company
Wickliffe, Ohio

ATKINSON, L., Works Mgr.
Frost Steel & Wire Company, Ltd.
250 Lottridge Street
Hamilton, Ont., Canada

ATWATER, ROBERT E., Mfg. Engr.
Westinghouse Electric Corp.
East Pittsburgh, Penna.

BAILEY, R. O., Chem. Engr.
American Chemical Paint Company
Ambler, Penna.

BAKE, E. G., Metallurgist
Steel Company of Canada
Canada Works
Hamilton, Ont., Canada

BALDRIDGE, W. M., Supt. of Wire Mill
Laclede Steel Company
Alton, Illinois

BALLANTINE, GEORGE W., Mgr.
Spec. Steel Products Division
Stevens Metal Products Company
Niles, Ohio

BAWDEN, WILLIAM D., Asst. Supt.
The Gilbert & Bennett Mfg. Company
Georgetown, Conn.

BAXTER, L. C., Gen. Mgr.
Baxter's Bolts, Screws & Rivets
Birmingham, England

BEAMAN, P. A., Mgr.
Wire Machinery Dept.
Morgan Construction Company
15 Belmont Street
Worcester 5, Mass.

BEARDSLEE, K. R., Vice Pres.
Carboloy Company, Inc.
Box 237, R. Pk. A.
Detroit 32, Michigan

BEIGHLEY, A. E., Sales Engr.
American Chemical Paint Company
1571 Lincoln Avenue
Lakewood 7, Ohio

BELL, W. M., Supt., Rod & Wire Division
Portsmouth Steel Corp.
Portsmouth, Ohio

BELORUSSOV, N., Asst. Chief Cable Commission
The Government Purchasing Commission of the USSR in the USA
210 Madison Avenue
New York, N. Y.

BENEKE, CHAS. J., Mgr.
Reynolds Metals Company
2500 South Third Street
Louisville, Kentucky

BENNETT, WILLIAM, Tool Engr.
Canadian General Electric Company, Ltd.
Hamilton, Ont., Canada

BENT, E. D., Cable Dev. Engr.
Northern Electric Company
1261 Shearer Street
Montreal, P. Q., Canada

BLACKBURN, P. W., Mgr.
North American Philips Company
100 East 42nd Street
New York 17, N. Y.

BLETSO, BRUCE, N., Equipment Engr.
American Steel & Wire Company
708 Rockefeller Building
Cleveland, Ohio

BORNE, RAYMOND, Foreman
Fort Wayne Wire Die, Inc.
2625 East Pontiac Street
Fort Wayne, Indiana

BOSWIN, GEORGE A., Sales Mgr. Garrett Div.
Hubbard Spool Company
1622 Carroll Avenue
Chicago, Illinois

BOYER, JOHN A., Metallurgist
The Niagara Wire Weaving Company, Ltd.
Niagara Falls, Ont., Canada

BRANTHWAITE, I., Supt.
Okonite-Callender Cable Company
Paterson, N. J.

BRATTON, W. J., Field Engr.
Carboloy Company, Inc.
844 South Canal Street
Chicago 7, Illinois

BRINKMAN, E. E., Plant Mgr.
A. Brandwein & Company
Chicago, Illinois

BRITTON, A. ARLINGTON, Jr., Asst. Gen. Supt.
The Carpenter Steel Company
Reading, Penna.

BROADDUS, E. T., Sales
Firth Sterling Steel Company
Kansas City, Missouri

BRODAHL, FINN, Chief Engr.
Mandel Nails & Wire Rope Company
Mandel, Norway

BROWN, C. E., Tech. Repr.
Shell Oil Company, Inc.
50 West 50th Street
New York, N. Y.

BROWN, JAMES R., Jr., Sales Engr.
Nukem Products Corp.
111 Colgate Avenue
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BROWN, R. M., Sales Engr.
Metal Carbides Corp.
107 East Indianola
Youngstown 5, Ohio

BROWN, R. W., Pres.
WBB Corp.
P. O. Box 4913
Mt. Airy 19, Penna.

BROWN, W. E., Wire Rope Engr.
The B. Greening Wire Company, Ltd.
Hamilton, Ont., Canada

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Syncro Machine Company
611 Sayre Avenue
Perth Amboy, N. J.

BUCHANAN, D. D., Mgr. of Operations
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Republic Steel Corp.
Massillon, Ohio

BURKMAN, C. H., Engr.
Firth Sterling Steel Company
McKeesport, Penna.

BYKOV, D., Chief Cable Commission
Soviet Purchasing Commission
210 Madison Avenue
New York, N. Y.

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Steel Company of Canada, Ltd.
Wellington Street
Hamilton, Ont., Canada

CAMPBELL, CHARLES H., Res. Met.
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Cleveland, Ohio

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Canadian Steel Corp., Ltd.
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Ontario, Canada

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CAVANAGH, P., Chief Met.
DuMont Laboratories
Passaic, N. J.

CLARK, A. R., Prop.
Vascarb Tool & Die Company
39 Cannon Street, East
Hamilton, Ont., Canada

CLARK, E. W., Cons. Engr.
Syncro Machine Company
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Perth Amboy, N. J.

CLARK, HERBERT, B., Gen. Sales Mgr.
Vascoloy Ramet Corp.
North Chicago, Illinois

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Toronto, Ont., Canada

COCKLIN, C., Supt.
Eaton Mfg. Company
Massillon, Ohio

COGAN, J. E., Service Engr.
National Machinery Company
Tiffin, Ohio.

CONDIT, P. N., Principle
P. N. Condit
Boston 17, Mass.

COPPICK, J. T., Sales Mgr.
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GOVERNMENT WIRE PRODUCTION INFORMATION

German Vanadium Recovery Methods

WARTIME shortage of vanadium as an alloy for steel led the Germans to devise methods for recovering this metal from the slag from Bessemer converters, according to a report now on sale by the Office of Technical Services, Department of Commerce. Although expensive, the German recovery methods might help to augment our vanadium supply, since they could be used in processing iron ores containing vanadium, the author states.

* * *

THE report was prepared for the Joint Intelligence Objectives Agency by **R. P. Fischer** of the U. S. Geological Survey.

* * *

DOMESTIC and Swedish iron ores used by the Germans contain about 0.1 per cent vanadium. When iron from this ore is converted to steel, the vanadium goes into the converter slag in a concentration of one per cent or more. If the slag is resmelted and the metal again passed through the converter, the vanadium may be concentrated in the slag to the extent of 10 per cent, enough to leach out by the sodium process. In this way, the Germans obtained an estimated 6,500,000 pounds of vanadium a year. It was needed for high-speed tool steel and as a substitute for other scarce alloying metals, especially molybdenum.

* * *

Papers for the 1947 Wire Association Technical Program

IT is highly desirable that members of the Wire Association give consideration at this time to the preparation of papers for presentation at the 1947 Wire Association Technical Sessions of the Convention to be held at Chicago in October. These papers are all given consideration for the Annual Medal Award of the Association.

SINCE it is only through cooperative effort of our members that a well balanced program may be presented it is requested that you advise as early as possible of your intention to submit a paper and give its general subject.

THE WIRE ASSOCIATION
Executive Secretary

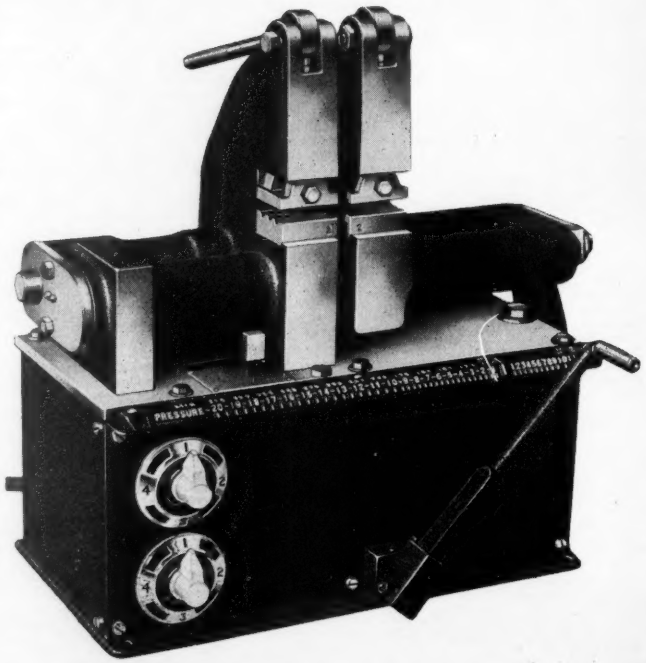
MICROMETER PRECISION — MICRO-WELD — TRADE MARK REG. U. S. PAT. OFF.

MODEL T-L MICRO-WELD BUTT WELDER

Welding capacity .080" to .375 diameter STEEL wire

The Model T-L Welder which is a self-contained unit suitable for various types of Butt welding, is equipped with individual hand clamps, and a single control lever for the spacing operation, applying the upset spring tension, and contacting the welding switch.

This unit can be supplied for either bench mounting, overhead crane, or mounted on 4-wheel truck.



MICRO PRODUCTS COMPANY
20 NORTH WACKER DRIVE,
CHICAGO 6, ILL.
Telephone: STATE 7468

RARER METALS
by Jack De Ment

Author Fluorochemistry; Co-author Uranium and Atomic Power, Fluorescent Chemicals and Their Applications, Ultra-Violet Light and its applications, etc. Research chemits, Fluoresence Laboratories.

and H. C. Dake, Ph.D.

Editor, The Mineralogist. Co-author Uranium and Atomic Power, Fluorescent Chemicals and Their Applications, Ultra-Violet Light and Its Applications.

* * *

With an introduction by Professor Colin G. Fink, Head of the Department of Electrochemistry, Columbia University.

* * *

THE outstanding characteristic of the metallurgy of the twentieth century is the commercialization of a large number of rarer metals. For some years there has been a need for a concise book in which the mineralogy, chemistry, physics and technology of these less familiar elements are described.

* * *

THIS volume correlates basic data on rarer metals for the busy professional man and student. It is suitable as a reference text or for supplementary reading in science and engineering courses. Special consideration has been given to rarer elements upon which much of our future progress may depend.

* * *

SOME twenty elements, excluding the metals of the rare earths on which there is extensive literature, are discussed briefly, including some of the interesting and important practical applications of these elements.

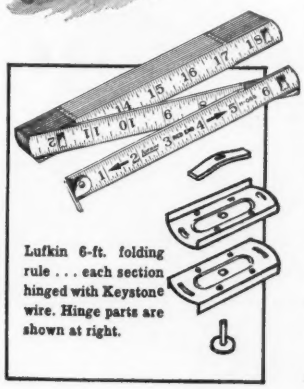
* * *

THE book does not give a survey of analytical methods, which may be found in any standard reference work on analytical chemistry, but newer tests, such as those of microchemistry and fluorochemistry, have been discussed. The stress has been laid upon specific tests which can be performed rapidly with simple equipment and satisfactory results.

* * *

392 pages, fully illustrated — price $7.50. — Published by the **Chemical Publishing Co., Inc.**, 26 Court St., Brooklyn 2, N. Y.

Every Lufkin folding rule has an extremely accurate hinge joint that keeps the rule in perfect alignment. Open a 6-ft. Lufkin "Red End" rule to its full length and then sight down the edge. You'll find it as straight as a plumb-line —and built to stay that way through years of hard use.



Lufkin 6-ft. folding rule . . . each section hinged with Keystone wire. Hinge parts are shown at right.

The heart of this precision-made joint is the sturdy tubular hinge rivet, made of specially-drawn Keystone wire . . . wire that must be uniform to within extremely close tolerances, ductile for proper fabrication, yet tough and springy to withstand tension and wear.

We are pleased that Keystone wire meets all these qualifications, helping keep the Lufkin rule a leader in its field. Whatever the wire need, Keystone can normally supply it.

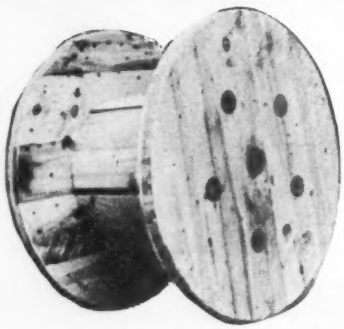
**Lufkin Rule Co., Saginaw, Michigan*

KEYSTONE MUSIC SPRING WIRE
KEYSTONE STEEL & WIRE CO. PEORIA, ILLINOIS

SPECIAL ANALYSIS WIRE for all industrial purposes

KEYSTONE STEEL & WIRE COMPANY
PEORIA 7, ILLINOIS

REELS



OF WOOD

RETURNABLE and NON-RETURNABLE

Furnished assembled or knocked down, made to your specifications. Will withstand severest handling. Sturdy, strong, low in cost. Made for

CABLE, ROPE and WIRE

in any size from 12″ to 96″ in diameter.

ALSO, REEL HEADS FOR STEEL DRUMS

Send us your specifications and let us quote on costs.

BRIDGE MFG. CO., Inc.

HAZARDVILLE • CONNECTICUT

Unique Display of Platinum Metals in Industry and the Arts

ONE of the first and most comprehensive exhibits of the platinum group of metals was staged at the **National Metal Exposition** in Atlantic City in November. The exhibit featured the six platinum metals — platinum, palladium, rhodium, ruthenium, iridium and osminum — and many important fields in which they play leading roles.

* * *

THE precious metals were shown in their raw state and in some of the manifold ways they serve industry and the arts. Examples of how the platinum metals distinguish themselves from other metals by a rare combination of properties which make them exceptionally valuable and in many cases indispensible, in the jewelry, dental, glass and textile fields as well as in research and process control, and in the electrical and chemical industries are part of the exhibit.

* * *

AN innovation is a display of jewelry and accessories directed principally to men. Here one will find new designs in the currently popular palladium and two-toned palladium-gold filled patterns. Tie clasps and money clips made of two-tone palladium gold filled are arranged in attractive settings. Also included are palladium engagement ring bands and settings for the bride-to-be.

* * *

PLATINUM and palladium alloyed with gold are extensively used in dentistry because of the strength, workability and pleasing color which they contribute to the finished alloy. These alloys are exhibited in the various forms in which they are employed in this field. Plate, wire and foil and such finished applications as tooth pins, tooth backings, bridges, bracing wires and inlays are shown in these precious metals.

* * *

IN the textile section are platinum-rhodium alloy spinnerets which emulate the silk worm in generat-

ing rayon fibres used in the manufacture of clothing fabrics, tire "cord", asbestos cloth for fire curtains and many other items. Platinum-rhodium spinnerets are also employed in the manufacture of a synthetic wool-like fibre derived from milk. Of interest is the miniature microanalysis set of platinum ware which permits non-destructive analyses, and is used to supplement X-ray and spectro-analyses.

* * *

Industrial Alarm System Will Signal Processing Dangers

A new signalling assembly and system which will sound an alarm when predetermined industrial processing temperatures, levels or pressures are reached, has been developed by the **Brown Instrument Company**, Philadelphia.

* * *

THE new assembly will warn of excessive flow, pressure, temperature or other factors which are ordinarily subject to manual control and human error.

* * *

THE assembly extends the principle of alarm signalling controls to a wide variety of processes. Contained in an explosion-proof housing, it is adapted to inherently dangerous processing, especially in the manufacture or use of highly explosive chemicals or elements.

* * *

TO be marketed by the Brown company under the name of the "Air-O-Larm", the assembly is capable of providing either audible or visual warnings of undesirable or dangerous conditions. It is available now.

TO WIRE MILL MEN

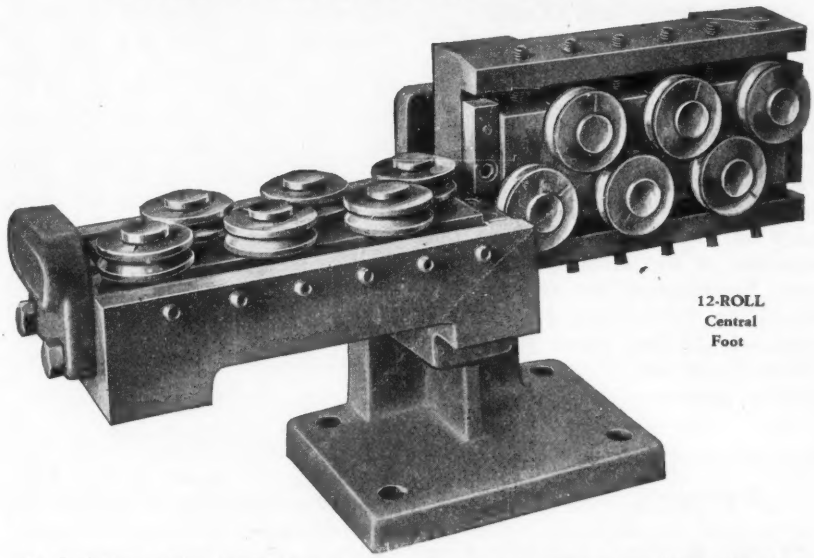
Have you considered joining the Wire Association? You are cordially invited to become a member. Dues are $15.00 a year, which includes a subscription to WIRE & WIRE PRODUCTS and a copy of the Annual Buyers Guide.

THE WIRE ASSOCIATION

300 Main Street,
Stamford, Conn.

TWO WIRE STRAIGHTENERS

WITHOUT CUTTING ATTACHMENTS



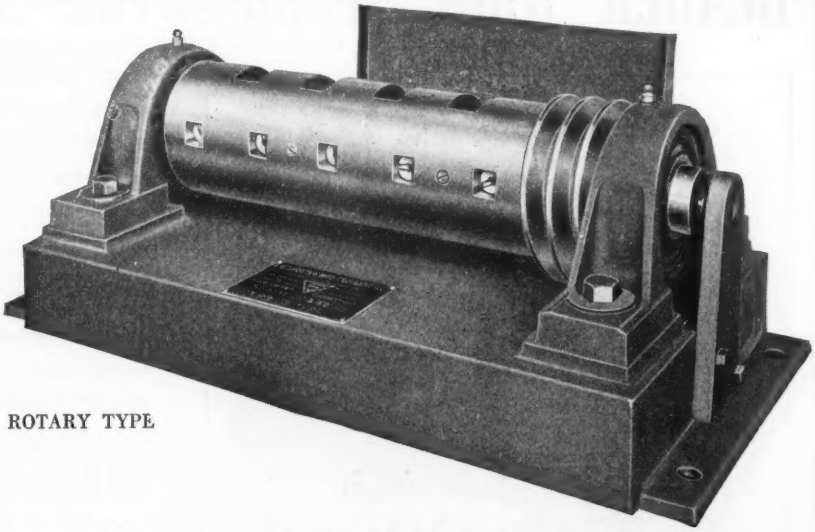
12-ROLL Central Foot

The Roll Type design shown above is generally used with automatic machines. The wire is drawn through the straightener to remove the natural curve and put it into better shape for the forming dies. Made in sizes from 1/16" to 1/2".

The Rotary machine shown below has no feeding attachment. The wire is pulled through mechanically while the head revolves at high speed. Made in sizes from 1/16" to 3/8".

In the case of either of these machines, the size indicates the maximum diameter of wire that can be handled, but several smaller sizes can also be worked.

Glad to send further information. It will help us in recommending a suitable material for the dies if, writing us, you give the diameters and kinds of wire you wish to straighten.



ROTARY TYPE

THE F. B. SHUSTER MFG. CO., INC., NEW HAVEN, CONN.

SHUSTER SINCE 1866

Automatic WIRE STRAIGHTENING AND CUTTING MACHINES

Outstanding Personalities of the Wire Industry

Volco Brass and Copper Company President Honored

NORMAN N. Coates, President of the **Volco Brass and Copper Company,** was awarded the honorary degree of Doctor of Science, by Bloomfield College and Seminary on November 24, 1946 on the occasion of the installation of the new President of the College Dr. Frederick Schwertzer. Mr. Coates was one of the founders of the Volco Brass and Copper Company and is prominent in the industry.

Sare Becomes President of Morrison Engineering Corporation

CARL R. Sare, formerly Vice President, has been elected President and a Director of the **Morrison Engineering Corporation,** Cleveland, Ohio, designers and manufacturers of industrial furnaces and ovens. Mr. Sare is a graduate of the University of Pittsburgh. He began his career with the A. M. Byer's Co. as a service engineer and following this served Jones and Laughlin Steel Corp. as a sales engineer. Prior to joining the Morrison Engineering Corporation, he was associated with the American Steel and Wire Co., as a production executive.

Keystone Names Director of Purchases

W. C. Erkert, Director and Purchasing Agent of the **Keystone Steel & Wire Company,** became Director of Purchases, effective November 1, 1946.

* * *

IN announcing the appointment, **R. E. Sommer,** President, stated that the Company's expansion program will be facilitated by Mr. Erkert's assumption of the direction of purchases.

* * *

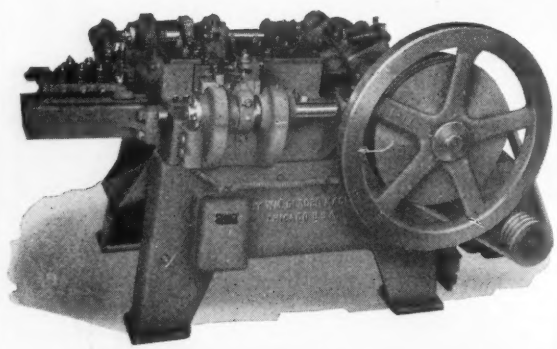
CONCURRENTLY with Mr. Erkert's appointment came the announcement that **F. A. Little** has been appointed to the position of Purchasing Agent.

* * *

MR. Little is experienced in purchasing. Before coming to Keystone, he was, for several years, General Purchasing Agent for the Nachman Company of Chicago. He was a Keystone Steel & Wire Company sales representative in the Minneapolis area for four years, then District Manager of the Chicago office of Keystone before becoming Assistant Purchasing Agent in 1941.

* * *

GLADER HIGH SPEED WIRE NAIL MACHINE



MACHINE ARRANGED FOR INDIVIDUAL MOTOR DRIVE

High tonnage output, and low maintenance costs, have resulted in Glader Machines being accepted as standard equipment in every large nail mill built in the United States in the past twenty years.

Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

For further information please address,

WM. GLADER MACHINE WORKS

210 No. Racine Ave.
Chicago 7, Illinois

Geary Stainless Appoints District Managers

GEARY Stainless Steel Company of Baltimore announces the appointment of **George Mc B. Peters** 528 White Building, Buffalo, N. Y. as District Manager for western New York and **Kenneth F. Vilsack,** 1230 Rowan Street, Louisville, Kentucky as District Manager for Kentucky and southern Indiana. Mr. Peters was formerly with Rustless Iron and Steel Company and Chandler Boyd Company and Mr. Vilsack was formerly with Jeffersonville Bolt and Machine Company.

* * *

Everett to Represent Hydropress, Inc., in Northwest

AFTER an extensive survey of the field, **W. Herbert Everett** has signed a contract to represent **Hydropress, Inc.**, New York builders of Hydraulic Presses, Rolling Mills and Die Casting Machines. Mr. Everitt's territory as sales representative will include the States of Washington and Oregon and British Columbia. Everitt, who graduated in Mechanical Engineering from the University of Washington, has worked for many years in designing, testing, research and development, and as a successful sales Engineer with leading concerns in the hydraulics field. He is located in Seattle, at 1743 First Avenue South.

* * *

Coonley Made President of International Organization Standardization

HOWARD **Coonley**, chairman of the Executive Committee of the **American Standards Association** has been elected president of the new International Organization for Standardization, the formation of which has just been completed by delegates from 25 nations meeting in London.

* * *

GUSTAVE **L. Gerard,** staff president of the Belgian Standards Association will be vice president of the new international organization which is expected to be known informally as ISO. Headquarters will be set up in Geneva, Switzerland.

* * *

FORMATION of the new ISO consolidates into a single organization the work of the old International Federation of National Standardizing Associations (ISA) and that of the war born United Nations Standards Coordinating Committee. The International Electrotechnical Commission, a third important standardizing agency, is expected to affiliate with ISO shortly as its electrical division.

* * *

HERE ARE SAVINGS THE EASY WAY WITH UNION'S RECLAMATION SERVICE

UNWIDIE

In the course of recutting your diamond and tungsten carbide dies, your die shop may have collected a quantity of rags, sludge, and other waste material impregnated with diamond powder.

One of the services which UNION offers you is reclamation of valuable and usable diamond dust from this apparently waste material. At very small cost, this waste, which had previously been thrown away, has been turned into real die shop savings for many of this country's largest wire mills.

Write our Stamford shop for particulars.

And don't forget that UNION diamond dies are also money-savers — the cheapest diamond dies per pound of wire drawn.

DIAMOND DIES

DIAMOND POWDER RECUTTING MACHINERY

THE UNION WIRE DIE CORP.

71 West 45th St., New York City 19

375 Fairfield Ave. Stamford, Conn.

Bastian Writes for Industry

IN an authoritative article recently published in the "American Machinist," **E. L. Bastian,** of Cleveland, presents a newly perfected technique for the improvement of shop control of oil concentrations used in metal cutting and grinding.

* * *

IN 1936, Mr. Bastian entered the employ of Shell Oil Co., as a service engineer. Progressing through various positions with Shell, Bastian became an authority on cutting fluids and emulsions used in precision metalworking. At present, he is Head Office Staff Engineer, in New York. He is a member of the American Society of Mechanical Engineers, N. Y.; The American Society for Metals, Cleveland; The American Society of Tool Engineers, Detroit; and the Wire Association of Stamford.

* * *

Portsmouth Steel Announces

D. **E. Fiore** has been appointed chief engineer at the Portsmouth Steel Co., Portsmouth, Ohio. He was formerly with Morgan Engineering Co., Alliance, Ohio.

* * *

USERS OF THESE CABLE REEL BORERS REPORT

PRODUCTION INCREASES UP TO 500%

In one single operation, this remarkable machine bores ALL the holes in a wooden cable reel head. In addition, it has the exclusive Root Patented Hydraulic Feed which provides a stepless range of feed from 2 to 29 strokes per minute. Operator is not handicapped by limited feed rate. This increases production tremendously. Can also be used for other boring purposes. Made in three sizes. *Write for Bulletin No. 132.*

"Can honestly say this machine alone has increased our production over 200%! Our profits increased 100%!"
V. Fairhurst, Mgr. New England Reel and Lumber Co.

ROOT
HYDRAULIC FEED
REEL BORER

Root Reel Borer being used by New England Reel & Lumber Co.

B. M. ROOT CO **YORK, PA.**

Furnace Engineers Appoint

BRUCE **Bevelheimer** has been named assistant to the vice-president of Furnace Engineers, Inc., Pittsburgh. He has been associated with the steel industry since 1924 when he joined the technical staff of Bethlehem Steel at the Sparrows Point, Md. plant. He has also been associated with the Algoma Steel Corp., Sault Sainte Marie, Ontario, since 1944.

* * *

Aiken Returns to Jones and Laughlin

THE many friends of **John C. Aiken** will be interested to learn that he was severed his connection with the **Steel Company of Canada Ltd.,** and returned to Pittsburgh. He is now in the South Side Plant. His address is Cold Finishing Department, **Jones and Laughlin Steel Corporation,** Pittsburgh, 3, Pennsylvania. Mr. Aiken had been with Jones and Laughlin for twenty-three years prior to going to Canada.

* * *

Nichols Makes Appointments

FRANK **R. Nichols,** President of the **Nichols Wire and Steel Company,** Davenport, Iowa, has announced the following organizational changes: **F. P. Leahy,** formerly Manager of the Battle Creek, Michigan, plant, has been apointed General Works Manager and will be in charge of the manufacturing plants at both Davenport and Battle Creek; **R. J. Kahl** takes Mr. Leahey's place as Manager of the Battle Creek plant; and **L. E. Batten** has been made Director of Purchases, with headquarters at the general office in Davenport.

* * *

New Aluminum Company

THE British Aluminum Company, Hawker Siddeley Aircraft and Tube Investments jointly are forming a new asociate company, called the **Aluminum Wire and Cable Company.** Nominal capital will be 500,000 pounds and initially each of the interested companies will be issued with 100,000 pounds of the capital. The board will include **Geoffrey Cunliffe** and **G. S. Boex** of British Aluminum, two directors of Hawker Siddeley and **Austyn Reynolds** of Tube Investments.

A Review of Recent Wire Patents

No. 2,410,594, CARRIAGE FOR METAL DRAWING APPARATUS, patented November 5, 1946 by Raynal W. Andrews, Jr., New Kensington, and Arthur T. Deily, Pittsburgh, Pa., assignors to Aluminum Company of America, Pittsburgh, Pa., a corporation of Pennsylvania.

More specifically the invention relates to a mechanism for actuating the work-gripping jaw, and includes a crank a lever oscillatable on a shaft and with the latter connected to the jaw, and a resilient association between the lever and crank for resisting relative rotation there between and to correlate their oscillations.

* * *

No. 2,410,766, APPARATUS FOR FABRICATING WELDED WIRE FABRIC, patented November 5, 1946 by Theodore Harry Wickwire, Jr., Ardmore, Pa., assignor to Theodore Harry Wickwire, Jr., Sophie H. Wickwire, Roma A.Wickwire, and Hedge Wickwire, doing business as a copartnership under the name of Theowick Company, Philadelphia, Pa.

The construction comprises a number of pairs of welding wheels, a feeder for feeding a wire strand between the wheels of each pair the pairs being in alignment on a line extending at right angles to the strands and a device for successively placing transverse wires across the strands and between the wheels of the pairs at an angle to these strands differing from 90°, whereby a transverse wire is between wheels of different pairs at different instants.

* * *

No. 2,410,815, METHOD AND APPARATUS FOR APPLYING ASBESTOS TO WIRE, patented November 12, 1946 by Kenneth A. Falconer, Auburn, Mass.

This method comprises advancing the wire (a conductor) lengthwise, continuously feeding a fleece of loosely associated, parallel fibers of asbestos in a direction approximately normal to the line of travel of the conductor, exerting a combined longitudinal and centripetal force on the fleece whereby it is compressed circularly and advanced longitudinally while supported out of contact with the advancing wire and then circularly compressing the thus condensed fibrous mass directly around the wire whereby the parallel association of the fibers of the fleece is not disrupted to any material extent so that the density of the fleece is not lessened by fiber disentanglement.

* * *

No. 2,411,284, NONDETERIORATING RUBBER INSULATED WIRE, patented November 19, 1946 by Donald J. Miller, Akron, Ohio, assignor to American Anode, Inc., Akron, Ohio, a corporation of Delaware.

It is stated that the insulated wire is freely flexible and its insulating properties unimpaired after 28 days in a Geer oven test. A coating of a neutral water-soluble polyvalent metal salt (such as zinc nitrate and calcium nitrate) and a water-insoluble inert powdery material (such as talc or diatomaceous earth) is disposed directly on the wire.

* * *

No. 2,411,410, ELECTROPOLISHING STAINLESS STEEL, patented November 19, 1946 by Glenwood J. Beckwith, Brecksville, Ohio, assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

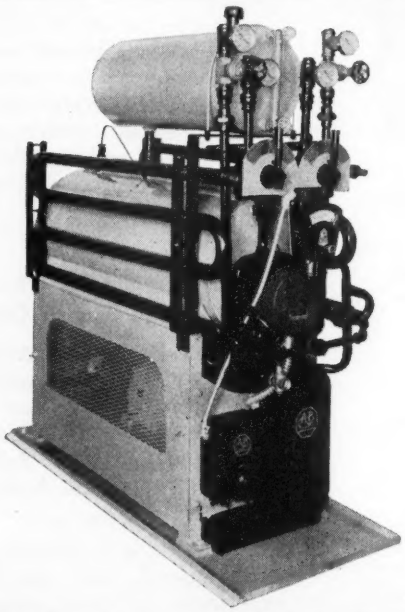
In carrying out this process, the steel is made the anode in an aqueous electrolyte consisting of approximately 80% by volume of phosphoric acid of 85% grade, together with approximately 15% by volume of 60° Baume sulphuric acid and about 5% by volume of a soluble pyridine compound. After providing suitable cathodes to assure uniform current flow from all parts of the anode, a current is passed through the resulting cell.

* * *

No. 2,411,593, CORROSION PROTECTION OF METALS, patented November 26, 1946, by Willis G. Routson, Berkeley,

(*Continued on page* 99)

Complete Description and Drawings of Patents May Be Had for 50 cents, outside the United States and Canada $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.



EXTRUDER TEMPERATURE CONTROL UNIT

- Wide Temperature range available
- Sustains high or low extruding temperatures
- Supplies — or removes — heat from extruder as required
- Multiple circuits can be accommodated
- Hand-lever selection of pre-determined extruding temperatures.
- Compact

JOHN ROYLE & SONS ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

James Day (Machinery) Ltd. London, England REgent 2430 | Home Office E. B. Trout J. W. VanRiper SHerwood 2-8262 | Akron, Ohio J. C. Clinefelter UNiversity 3726 | Los Angeles, Col. H. M. Royal, Inc. LOgan 3261

PATERSON 3, NEW JERSEY

DuPont Issues Booklet Depicting Relationship of Colors To Production Efficiency

"DU Pont Color Conditioning for Industry," a new 32-page booklet illustrated in full color, is available on request to the Finishes Division, Dept. M-6 Wilmington 98, Delaware.

* * *

ILLUSTRATING and describing years of research and practical experience with color to increase production, improve seeing conditions and create a better working environment, the booklet makes clear the fundamental principles on which color conditioning is based.

* * *

THE "Three-Dimensional Seeing" treatment of machines is depicted with photographs of actual installations. The Safety Color Code for Industry is also outlined. Color Conditioning is shown at work in plants of several well-known companies. A coordinated functional color program for an entire plant is illustrated in a double-page cutaway drawing.

FIRST
. . . AND STILL FOREMOST
The American Chemical Paint Company has made many contributions to industry through its pioneering research in metal protection and preservation. First in the field of metal working chemicals since 1914, ACP has blazed the trail for more than thirty years with an impressive list of FIRSTS.

CHEMICALS ACP PROCESSES

RUST PROOFING
Granodine
Duridine
Alodine
Lithoform
Thermoil-Granodine

RUST REMOVING AND PREVENTING
Deoxidine
Peroline

INHIBITORS
Rodine

FIRST to introduce an efficient rust-remover to the metal working industry. DEOXIDINE*, the FIRST phosphoric acid metal cleaner and rust-remover, is now a standard product.

FIRST to produce an effective inhibitor—RODINE*—for scientific control of pickling acids.

FIRST to develop a low-temperature phosphate-coating process—Cold Spray GRANODINE*.

AND NOW

FIRST to make simplified and effective aluminum rust-proofing available to industry. Aluminum treated with ALODINE* is highly corrosion-resistant and excellently conditioned for bonding paint.

* Trade Mark Reg. U. S. Pat. Off.

AMERICAN CHEMICAL PAINT CO.
AMBLER ACP PENNA.

New Technical Data Book On Packaging Materials

PROTECTIVE Coatings Corporation, 689 Main Street, Belleville, 9, New Jersey, has just issued a very complete 8½" x 11" brochure of sixteen pages and cover on its various products for the protection of packaged products in transit or storage.

* * *

THIS brochure describes **Aquastop** (two types); M-V-Var; Antaqua, waterproof coating and Plastipeel, for protecting metal parts with a unique, peelable plastic coating.

* * *

NUMEROUS charts and illustrations interpret physical characteristics and procedures; the application of Aquastop as case panels or pre-fabricated bags; and the methods of sealing to provide a completely waterproof package. Results of tests made by the manufacturer and users of the several materials are described in detail as are the methods of application in a number of forms to a wide variety of end products.

* * *

EMPHASIS is placed on the use of Aquastop to protect shipments of fresh foods and pharmaceuticals by air, water or ground transportation and includes detailed procedure for protecting shipments of such products.

* * *

Farrel-Birmingham Reopens Chicago Branch Office

FARREL-BIRMINGHAM COMPANY, INC., of Ansonia, Conn., and Buffalo, N. Y., has reopened its branch office in Chicago, locating at 120 South La Salle Street, room 542, telephone Andover 3300.

* * *

THE office is in charge of **Harry Temporal**, who has had wide experience as sales representative in the numerous fields for which the company builds equipment. Mr. Temporal has been connected with the company for twenty-six years, having first joined the Farrel Foundry & Machine Company at Ansonia in 1910.

Atlas Mineral Products Company Announces New Affiliate

THE Atlas Mineral Products Company, manufacturers of Acid — and Alkali-Proof Cements, Acid and Alkali-Proof Floors, Plastic Linings, Jointing Materials and Protective Coatings, announces the formation of an affiliate organization, The Atlas Mineral Products Co. of Texas, Inc., located at Houston 1, Texas.

* * *

THE new affiliate organization includes a manufacturing plant for sulphur cements and other firm products and handles the sales of Atlas products in the territory west of the Mississippi with the exception of Minnesota, North Dakota and western Missouri. It will also handle sales in western Tennessee, Mississippi and Louisiana. The address of the new affiliate is P. O. Box 252, Houston 3, Texas.

* * *

New Metallizing Handbook

THE latest and most complete collection of technicaland operating data on the Metallizing Process is contained in the fourth edition of the METCO Metallizing Handbook, published by Metallizing Engineering Co., Inc., Long Island City 1, New York.

* * *

IN addition to up to the minute data on preparation of surfaces, metallizing technique and finishing procedure, complete data on corrosion resistance, specific gravity, hardness, bond strength, tensile strength and relative shrink are contained in many interesting chapters.

* * *

PROFUSELY illustrated with pictures, drawings, diagrams, charts, and graphs, this 86-page, pocket size handbook presents both practical and technical aspects of the Metallizing Process in complete detail.

* * *

THIS book may be secured from the company above. Price: $2.00.

Reprints of Technical Articles Available

THE following reprints of technical articles which recently appeared in the Trade Press are now available.

"SODIUM HYDRIDE DESCALING" — Reprint of article describing a steel mill's experience with sodium hydride descaling in salt bath furnaces.

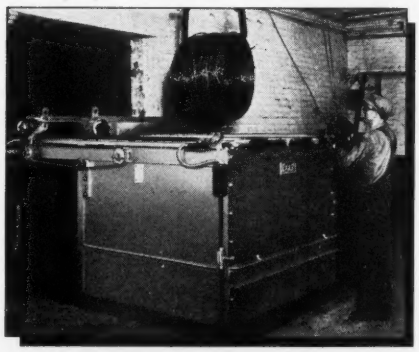
"SODIUM HYDRIDE DESCALLING AND DESANDING OF FERROUS CASTINGS AND FORGINGS" — Reprint of article dealing with special application of sodium hydride process to iron castings and forgings.

* * *

THESE articles may be obtained by addressing the Ajax Electric Company, Inc., Frankford Avenue at Delaware Avenue, Philadelphia 23, Penna.

SPEEDY, SCALE-FREE WIRE ANNEALING

★



Unique Ajax Electric Salt Bath Method provides fast, scale-free production—without decarburization. Cuts operating costs—greatly increases pot-life!

★

Added advantages in this modern, proved annealing method are—less floor space required, less labor, low maintenance cost, shorter time cycles (rarely over 20 minutes), no atmosphere equipment, no scaling, no explosion hazard. This modern electric salt bath annealing by the famous immersed electrode internal heating principle is ideal for annealing low carbon, high carbon and stainless steel wire and rod—in gauges from .020" to .250". Or for annealing aluminum, and copper and silver alloys. Also for descaling stainless and alloy steel wires in molten caustic soda. Recently developed salt mixtures greatly lower the cost of these operations. Interesting case-histories are available. Write for list of users.

AJAX ELECTRIC CO., INC.

FRANKFORD AND DELAWARE AVES., PHILADELPHIA 23, PA.

THE WORLD'S LARGEST MANUFACTURER OF ELECTRIC HEAT TREATING FURNACES EXCLUSIVELY!

THE **AJAX** HULTGREN **ELECTRIC SALT BATH FURNACE**

ASSOCIATE COMPANIES:
Ajax Metal Co.—Ajax Electric Furnace Corp.—Ajax Electrothermic Corp.—Ajax Engineering Corp.

Blending Soaps with Organic Solvents

THE ways in which co-solvency opens possibilities of soap blending in various technical products are indicated by **S. R. Palit** in a paper presented at the nineteenth annual fall meeting of the **American Oil Chemists' Society,** and subsequently published in **Oil and Soap** (23:72, 1946). Illustrating the importance of such a development, Palit cites the following as some of the chief uses of soaps in organic solvents: (a) emulsification, as for example, in the manufacture of soluble oils, to be used as cutting oils, textile oils, agricultural sprays, etc.; (b) lubricating greases and oils; (c) specialty soaps, e. g. mechanics' washing soap, pine oil soap, trichlorethylene soap (Westropol soap), liquid soap, transparent soap, metal polish, leather polish, shampoo, shaving paste, etc.; (d) dry cleaning; (e) defoaming, and so on.

* * *

THE chief difficulty in the manufacture of such industrial products is to incorporate soap in a hydrocarbon-type solvent, because in such solvents the usual alkali metal soaps are practically insoluble. Several methods are employed to avoid this difficulty. One is to use a large excess of a fatty acid, sometimes in the presence of alcohols. Other processes employ specialty soaps. However, Palit's work shows that ordinary soap can be dissolved in hydrocarbons by the use of suitable co-solvents.

* * *

IT is observed that the solubility of soap in dibutyl tartrate is very high, and is greatly increased by the presence of small proportions of hydrocarbons or chlorinated hydrocarbons. Thus, 100 Gm. of dibutyl tartrate dissolves 41.3 Gm. of sodium oleate at 25°C. and an addition of about 20 per cent of chloroform, benzene, amyl alcohol or other suitable solvent increases the solubility by 10 to 30 per cent. A very useful property of such solutions is that they can be diluted with light petroleum fractions without precipitation of the soap. Hence, to prepare soluble oil, commercial soap, particularly castile soap, is dissolved in dibutyl tartrate containing 20 per cent benzene or trichlorethylene. In this way, a 30 per cent solution of soap is easily prepared, and this soap solution is diluted with vegetable or mineral oil, to make a final soap concentration of about 3 to 5 per cent.

* * *

THE oil so prepared can be thinned to a creamy emulsion with water, the emulsion thus formed being very stable. By changing the type oil, it is possible to make cutting oil, textile oil, agricultural spray, etc. The same stock solution of soap can be used for dry cleaning, since it can be diluted by dry-cleaning fluids, such as Stoddard solvent, without precipitation of soap. Such solutions have good detergent power.

. . . and paint it not with just one coat, but with 12 consecutive saturating and finishing coats, at the rate of 72,000 feet per hour! A real job for the application of heat in continuous processing operations . . . so the problem was turned over to IOI.

Result: IOI engineers constructed from standard component parts the installation shown above. This specifically designed system delivers 25% more production at 30% less attendant cost, operates over an .010" to .750" diameter range, and produces coated wire that tests higher for luster and concentricity of finish.

This system is typical of IOI's engineering versatility in applying its sound basic principle to the industrial processing of monofilament and web materials . . . *putting heat to work in continuous operations*

Complete details of IOI installations adaptable to your industry are available in booklet form. Copies will be sent upon request.

INDUSTRIAL IOI OVENS, INC.
13825 TRISKETT ROAD CLEVELAND 11, OHIO
ASSOCIATED COMPANY: JAMES DAY MACHINERY LTD., LONDON W.1, ENGLAND

New Book on Preformed Wire Rope

WHEN a producer begins to think that everyone knows of his product, how it is made and what it does — that individual is due for an abrupt awakening. At least that is the opinion of the Preformed Wire Rope Information Bureau, who has just published a new book "Preformed Wire Rope—What it is—What it does".

* * *

ALTHOUGH preformed wire rope has rapidly advanced in universal acceptance since its introduction in 1924 (it now commanding about 45% of total wire rope production) any survey, according to the Bureau, would turn up many wire rope users who never heard of the word "preformed". This is due largely to the heavy turnover in industrial personnel during the past five years. Realizing this, the Bureau has issued a book which capably answers the elementary question: "What is preformed wire rope?"

* * *

WELL illustrated, and in three colors, this book tells the story of the development of preformed wire rope and what that development has meant to all industry. In non-technical language it tells what the preforming process does to the wires in a rope and what effect it has on the rope's final service.

* * *

AS an example, the accompanying chart (reproduced from the book) shows the average difference in service life between preformed and non-preformed wire rope on ten different machines.

* * *

COPIES of the new book may be obtained by writing any wire rope manufacturer or the **Preformed Wire Rope Information Bureau**, 520 North Michigan Ave., Chicago 11.

Steel Wire Products Used in Automobiles

AN interesting compilation of data has been made by the A. I. & S. I. showing the amount of steel in the form of wire products used in an average motor car. These figures, in pounds of steel, are:

Steering Mechanism	**2.42**
Engine & Clutch	**4.56**
Brakes, wheels & tires	**6.50**
Body	**83.76**
Rear Axle & Suspension	**3.33**
Transmission	**3.32**
Chassis	**3.38**
Other Parts	**79.73**
TOTAL	**187.00**

* * *

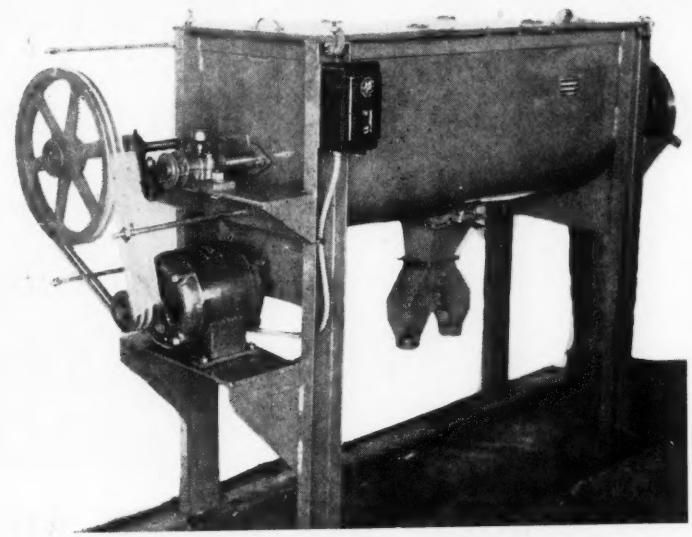
AS 3545 pounds of steel is purchased for the average car, the 187 pounds, which is approximately 5.3 per cent of the car's steel, is in the form of wire products. This does not take into account the large amount of electric wire that is also used.

CHEMICAL **MIXERS**

Horizontal Batch and Continuous Types made in 1 cu. ft. to 235 cu. ft. capacities, Either Jacketed or Plain.

Custom Mixers Engineered To Suit Requirement of User.

Also make Grinders, Crushers, Elevating and Conveying Equipment, Commercial Type Pressure Cookers, Stranders, Closers, Wire Winders and a General Line of WIRE MACHINERY.



The machine illurtrated above is a horizontal mixer.

Put your mill equipment problems up to the

HUGHESVILLE MACHINE and TOOL COMPANY

HUGHESVILLE, PENNA.
WIRE AND PROCESS MACHINERY

Phone: 129-A

Mines Register

THE latest edition of **MINES REGISTER,** by completely revising the 1942 edition, has brought the information on mining properties in the Western Hemisphere up to date. The book contains descriptions of approximately 4,500 active mining companies, and also lists more than 25,000 inactive mines.

* * *

TO facilitate the use of the Register, the mining companies producing non-ferrous metals as well as precious metals are listed alphabetically. Each report contains a short history of the company; its financial structure, description of its mining properties; its production; type of equipment used; the officers and directors of the company and names of the mining engineer, manager, superintendent and purchasing agent.

* * *

A special section lists all active mines according to their geographical location. Some of the leading non-ferrous metal mining companies in various parts of the world are described in a special section.

* * *

OTHER features included in the edition are statistical section on non-ferrous metals; an alphabetically arranged list of officers and directors and companies with which they are affilliated; an alphabetically arranged list of consulting and mining engineers, superintendents and purchasing agents and their company affiliations; a special section devoted to security prices of mining companies that are listed on the important exchanges in the United States and Canada, giving the highs and lows for the years 1941 through 1945; an extensive "Where to Buy" section which is an index of manufacturers and distributors of mining machinery, equipment and supplies. In this section the companies are listed geographically. There is also an equipment and supplies section where the products are listed according to the commodities with the name of the manufacturer or distributor.

* * *

MINES REGISTER (6" x 9", over 700 pages) is published by the **Atlas Publishing Company,** 425 West 25th St., New York 1, N. Y. The price of Mines Register is $20.00 postpaid.

* * *

Glycerine in Metal Coated Articles

A new use for glycerine is given by W. W. Hamel in U. S. Patent 2,400,304. This document describes a method whereby materials ordinarily burned or damaged by heat may be coated with a continuous and air-impervious layer of metal which is sprayed on in the molten state. The secret of the process lies in the use of glycerine solutions which act as protective liquids that vaporize during the actual spraying without leaving a residue.

* * *

SUCH a protective liquid may consist of a mixture of equal

AUTOMATIC
STRAIGHTENING AND CUTTING
MACHINES
equipped with
FLYING SHEAR
for
ROUND AND SHAPED WIRE AND ROD

THE HALLDEN MACHINE CO.
THOMASTON, CONNECTICUT

parts of glycerine and water, but the proportions may be varied, even to practically excluding water. The first step is to wet the material with the glycerine-containing protective liquid. The molten metal may then be sprayed on by any standard process. Spraying must be done rapidly — in a matter of seconds; the time element depending on the temperature of the spray and other factors.

* * *

THE method is applicable to paper, wood, plywood, leather, textiles, regenerated cellulose sheets, rubber and also to various plastics, glass, and ceramics. Sprayable metals used in the molten state include aluminum, copper, gold, silver, zinc, tin, brass, and even various stainless steels.

* * *

WITH this glycerine-utilizing process, the metal coating adheres so firmly that the articles can be subjected to mechanical stresses without danger of separating. The coatings can be buffed or polished or given other finishing treatments.

* * *

IF desired, such coated articles may be plated, the metal coating or layer serving as a conducting cathode. The use of non-conducting "stop-offs" permits the creation of various decorative, effects. Papers coated with a thin layer of aluminum or tin by this process have proved to be impervious to air and liquids and are admirably suited for use in packaging foods.

New Low-Melting, High-Strength, Silver Welding Alloy

THE need for a welding alloy that will provide high strength welds in ferrous and non-ferrous metals at an exceeedingly low melting point has been met by the Research Department of the **Eutectic Welding Alloys Corporation.** Known as EutecRod 1801, this alloy is the latest addition to the line of "Low Temperature" Welding Alloys produced by this company.

APPLIED by the oxyacetylene torch, furnace, or high frequency induction heating equipment, it bonds at base metal temperatures of 940° - 1120° F, and melts at 1143° F. This low melting temperature makes it possible to produce superior welded joints at new low costs. At this temperature, it will flow freely into close-fitting joints due to its extremely high capillary action. In addition, weld deposits will have a shear strength of 120,000 psi., good corrosion resistance and good electrical conductivity.

* * *

THIS welding rod is available in rod, wire, strip, and powder form. It is used with a special, high quality flux.

SEND IN
YOUR ORDER NOW
for the
1946 WIRE BUYERS GUIDE

WIRE SPOOLING
OUR SPECIALTY

BUT WE WILL SPOOL ANYTHING YOU HAVE

—— PERMIT THIS MACHINE ——
TO DO YOUR EXTRA SPOOLING

90 Head Available — Low Price — Good Spooling
Quick Delivery — Write, Phone or Wire.

* * *

Why Not Allow Us To Quote You

* * *

JERSEY SPECIALTY CO.
LITTLE FALLS 4-0784. **LITTLE FALLS, N. J.**

Valve Spring Wire

A triumph in the art of manufacturing quality steel wire has been achieved by the **American Steel and Wire Co.**, U. S. Steel subsidiary, in producing great amounts of valve spring wire so vital to the efficient operation of America's postwar automobiles.

* * *

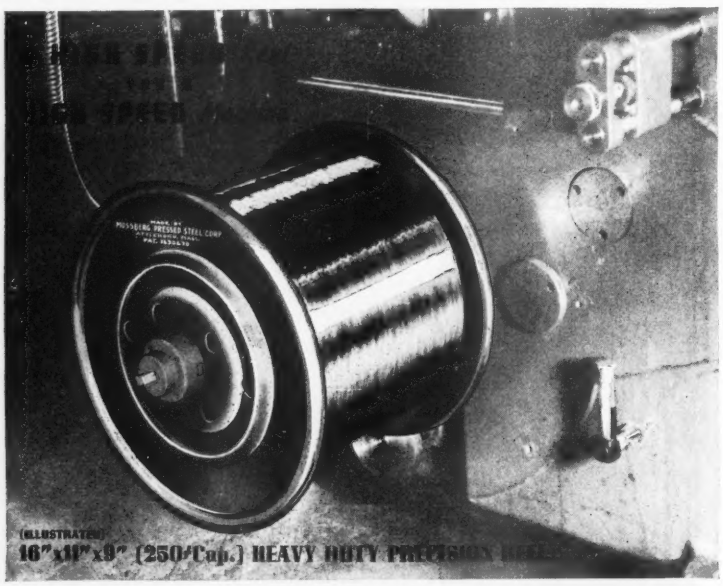
PRIOR to the outbreak of World War II, virtually all of the steel rods for reduction into wire for automotive valve springs were imported from Sweden. In that country, extremely high grade ores were readily available. Swedish iron plants, for the most part, were small units utilizing charcoal rather than coke for fuel, resulting in a cleaner iron and a cleaner steel. Rolling mills were small, hand-operated units which, while producing comparatively small tonnages, permitted extreme care to be exercised in producing steel rods with virtually no seams or scratches. Extremely high surface qualities are of great importance when attempting to avoid failure of the material used in springs which are compressed and released 4,000 times each minute.

* * *

WITH the advent of the war in 1939, shipments from Sweden were cut off and metallurgists of the American steel industry, including American Steel and Wire, were faced with the problem of replacing that source of high-grade steel rods. The result was that a product superior even to the Swedish material was developed for use in the last of the pre-war automobiles. It played an important war-time role in keeping in operation the jeeps, peeps, half-tracks, tanks, and other mobile equipment so vital to the winning of the war.

* * *

EXTREME care is exercised in choosing raw materials for this premium steel product. Only carefully graded pig iron and steel scrap are used, and improved steel-making practices have been developed. Special heat treating methods together with close rolling and drawing controls, also contribute toward producing a high-quality steel wire free from surface imperfections and possessing other physical properties rendering it more than adequate to make American automobile manufacturers independent of the foreign source of supply.



MOSSBERG PRESSED STEEL CORP.

OFFERS: BALANCED PRECISION REELS

in HEAVY DUTY construction for use on modern HIGH SPEED wire drawing machines.

To provide higher operating efficiency, with the ever increasing tendency towards the drawing of finer gauge wire on larger reels at higher speeds, the following reel requirements are now essential:

(1) PROPER PROPORTION
(2) BALANCE
(3) ACCURACY
(4) STRENGTH
(5) DURABILITY

All these requirements are incorporated in spools & reels made by

MOSSBERG PRESSED STEEL CORP.

18 WEST STREET ATTLEBORO, MASS. U. S. A.

Handy & Harman Builds West Coast Plant

G. H. Niemeyer, President of **Handy & Harman**, New York, has just announced that his company is building a new plant in Los Angeles, California, to more completely serve the increased demand for gold and silver as well as refining service on the Pacific coast. The company established an office in Los Angeles in the Bendix Bldg., in 1943 to warehouse brazing products for war industries and to serve users of gold and silver for the Arts. This office was moved to the new location at 3625 Medford Street, Los Angeles, where the plant opened the latter part of 194

Iron and Steel Scrap

FOUNDRIES and Mills Need Scrap — Approximately a million gross tons of purchased iron and steel scrap are needed each month if steel mills and foundries are to operate at optimum capacity. During the coal strike last spring, the steel industry found it necessary to limit the use of fuel for pig iron production. The resulting pig iron shortage increased the scrap charge in steel furnaces, and following settlement of the coal strike, a severe scrap shortage developed.

* * *

SCRAP Drive Making Progress — — On July 15, a scrap drive was initiated by the Office of War Mobilization and Reconversion. Special drives were organized in the railroad, petroleum, mining, public utilities and automotive industries, and the 70,000-odd industrial plants throughout the country were brought into the scrap drive through industrial salvage committees organized in 835 industrial areas. To obtain scrap from farms, personnel of the Department of Agriculture who are in direct contact with farmers have been enlisted and the Department of Agriculture's Division of Information is publicizing the drive through rural radio stations and farm periodicals. Manufacturers of farm equipment and their retail dealers are also cooperating in collecting scrap from farms.

* * *

SHIPBREAKING Increases — Probably the most spectacular aspect of the drive was the initiation of the shipbreaking program. To expedite the output of ship scrap and move the product to the steel mills as quickly as possible, CPA established the Office of Shipbreaking Consultant. In the three months since the establishment of this office, rapid progress has been made in carrying out the purpose of the shipbreaking program Surplus shipyards have been opened for scrapping purposes. During September, fourteen Maritime Commission shipyards were made available for leasing by the War Assets Administration to companies who qualify as shipbreakers. During October, an additional eight Navy Department shipyards were made available. Of these 22 yards, three are in New England, five are on the Gulf Coast, three are in the Midwest, and three are on the West Coast. Negotiations have been completed or are in progress for the sale or leasing of eight of these yards.

* * *

AT the present time, seventeen companies are engaged in the shipbreaking program on an active basis, and nineteen more are seriously considering entering the business. Several of the latter group have purchased ships but have not yet obtained shipbreaking facilities. One new yard was constructed out of private funds recently from an undeveloped waterfront site, and is breaking ships at the rate of 800 tons a week.

* * *

SHIPS to Yield 180,000 Tons by Year's End — In July, it was estimated that steel scrap production from shipbreaking was running

For WIRE DRAWING DIES and TUBE DRAWING DIES

USE OUR 9 AND 9A TUNGSTEN CARBIDE NIBS.

Our 9 and 9A Carbides are compounded especially for wire and tube drawing dies. All standard sizes.

Special sizes and shapes made to print.

For COLD HEADING DIES

USE OUR 9A2 TUNGSTEN CARBIDE NIBS.

9A2 is a tough carbide developed by us especially for use in long-life cold heading dies.

●

THE ABOVE ALSO SUPPLIED ROUGH CORE

●

You will be pleased with our prompt deliveries.

TUNGSTEN ALLOY MANUFACTURING CO., INC.

65 COLDEN STREET, NEWARK 4, N. J.

Tel. MArket 3-3959

at 15,000 tons per month. The preliminary estimate for November indicates a rate of 33,000 tons per month. About 180,000 tons of scrap from ships will have been produced by the end of the year, by which time it is estimated that shipbreakers will be producing at the rate of 40,000 tons per month.

* * *

MELTING of Purchased Scrap at High Levels — Overall results of the drive cannot be measured quantitatively but steel companies have been able to continue production of 500 tons of bale wire in coils were produced to be used with fully mechanized balers in place of the conventional bale tie.

* * *

Copper and Copper Products

NEW Postwar Peak in Refined Copper — Domestic refined copper production in October increased 15 per cent further to 77,900 short tons from 67,800 tons in September, and was 10 per cent above the postwar peak of 70,400 tons produced last October. Approximately 33,000 tons of foreign refined copper were available for use in October compared with 21,400 tons revised) in September.

* * *

REFINED copper deliveries to customers increased 20 per cent in October to 136,500 tons from 113,200 tons (revised) in September — the largest gain since May 1945 when 139,200 tons were delivered to fabricators. Approximately 51,000 tons of government-owned refined copper were authorized by CPA for release from the Office of Metals Reserve stockpile for use by brass mills and wire mills. Revised figures indicate that the Metals Reserve stockpile at the end of September was 157,300 tons.

* * *

OCTOBER deliveries of brass mill product jumped 18 per cent to 249 million pounds from revised September deliveries of 211 million pounds, and were 149 per cent above average prewar monthly production of 100,000 million pounds (1935-40).

* * *

PRODUCTION Gains Reported — that approximately 105 million pounds of wire mill products were delivered in October compared with revised September deliveries of 102 million and prewar average monthly deliveries of 135 million pounds in 1941. Deliveries of magnet wire in September dropped to 22.3 million pounds from 24.6 million in August.

* * *

Insect Screen Cloth

PRODUCTION Gains Reported — Revised production data received from the steel, bronze and copper insect screen cloth industry indicate that September output was 31 million square feet and that October output was slightly higher. During the first nine months of 1946, production totaled 262 million square feet; galvanized steel insect screen cloth comprised 62 per cent of the total, bronze, 37 per cent and copper 1 per cent. Overall production from quarter to quarter has remained fairly steady, but the volume of copper insect screen cloth has varied from as much as 700,000 square feet in March to 45,000 square feet in

1926 — pioneered the first practical controlled-atmosphere furnace

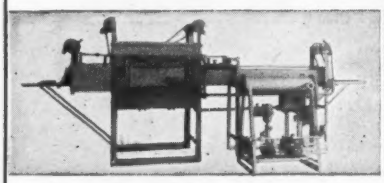
"Certain Curtain" ELECTRIC FURNACES

TODAY — providing the most advanced types of controlled-atmosphere furnaces

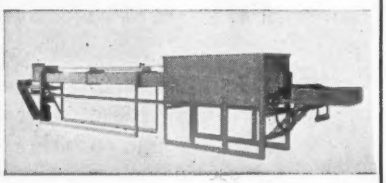
CLEAN

annealing
copper brazing
silver soldering

"CERTAIN CURTAIN" ELECTRIC FURNACES



Type LA, for soldering, brazing and annealing, with external atmosphere generator.



Type LAC, for conveyor soldering, brazing and annealing.

Finest controlled atmosphere results

The famed "Certain Curtain" controlled-atmosphere furnaces increase speed of production, decrease spoilage, often entirely eliminate cleaning and pickling operations. Three types of atmosphere preparation and control give you precision and completeness of atmosphere protection assuring clean, uniform work of maximum working life. Our line also includes furnaces for hardening tools and dies, conveyor hardening of small parts, sintering, brazing carbide tool tips, tempering, etc.

Write for "CATALOG 108"

C. I. HAYES, INC. 129 Baker St., Providence, R. I.

August. Although some increase in supplies of insect screen cloth may result from price decontrol, the outlook for 1947 is one of continued deficits of very large magnitude.

* * *

Wirebound Boxes Scores

THE wirebound box industry, which supplies essential packaging for both agricultural and industrial products, operated at only 45 per cent of machine capacity in the third quarter. September production is estimated at approximately 90 million surface feet. The decline in production was due to inability of producers to purchase lumber and veneer and to a developing shortage of wire.

* * *

New Temperature Controller Announced by Leeds and Northrop

READY for control of ovens, stills, baths, presses and coolants, L&N's new Electromax fills the long-felt need for an inexpensive temperature controller which has high sensitivity and versatility and needs practically no attention.

* * *

ESPECIALLY designed for those applications where indicating and recording are not required, Electromax signals and controls only, although temperature readings can be taken manually with it at any time.

* * *

THE instrument consists of a Wheatstone bridge circuit with a vacuum-tube amplifier as the detector. Vaccum tubes are standard, easily-purchased types, require no matching, balancing or other special selection. It's completely a-c operated—needs no dry batteries or standard cells. The lack of indicating or recording mechanism makes it a practically "zero maintenance" instrument.

* * *

TEMPERATURE-SENSITIVE elements used with Electromax are Thermohms, L&N resistance thermometer bulbs. As with other L&N instruments, the length of leadwires does not affect calibration, and the location of thermohms can be changed whenever desired.

THE instrument case is only 11-9/61" x 11-1/16" x 9-1/16" and can be mounted wherever convenient. Standard ranges are 0 to 250 F and 0 to 1000 F or the corresponding ranges of 0 to 150 C and 0 to 550 C.

* * *

FOR further information write to **Leeds & Northrup Company**, 4934 Stenton Avenue, Philadelphia 44, Penna.

* * *

Wireless Started in Wilds

FRONTIER Alaska had the first wireless service for commercial use in 1904 when the U. S. Army Signal Corps operated it between Nome and St. Michael, a distance of 100 miles. Today the Regular Army has a vast network of railroad, airport, telegraph, and radio communication services in that fast-developing territory.

* * *

ANNOUNCEMENT

The Charles P. Boyd Corporation has recently purchased the complete spooling machine business of the Fidelity Machine Company, and will continue to manufacture the high quality wire spoolers formerly made by that company. Our aim will be to give reasonable delivery service.

•

Reasonable Prices *Write for Catalogue*

•

CHARLES P. BOYD CORPORATION

202 NORTH TWENTY-FIRST STREET
PHILADELPHIA, 3, PENNSYLVANIA.

Attendance List October 1946 Wire Association Convention

(Continued from page 67)

TURNER, A. J., Asst. Supt.
Steel Company of Canada, Ltd.
Hamilton, Ont., Canada

ULSHAFER, CLARENCE, Chief Engr.
Hughesville Mach. and Tool Company
Hughesville, Penna.

VANDER PYL, CHARLES M.
Mossberg Pressed Steel Corp.
Attleboro, Mass.

VAN HOOK, CHAS. G., Mgr.
The Watson Machine Company
Paterson, N. J.

VAN VALKENBURG, F. S., Engr.
Waterbury Farrel Foundry & Machine Company
Waterbury, Conn.

VAUGHN, L.A., Pres.
Vaughn Machinery Company
Cuyahoga Falls, Ohio

VERCOE, F. H., Asst. Works Mgr.
The Steel Company of Canada, Ltd.
Toronto, Ont., Canada

VOIGTLANDER, C., Supt. Wire Mill
Union Wire Rope Corp.
21st & Manchester Streets
Kansas City, Missouri

VOORHEES, H. W., Engr.
John A. Roebling's Sons Company
Trenton, N. J.

WAARICH, O. W., Gen. Supt.
Pheoll Mfg. Company
5700 Roosevelt Road
Chicago, Illinois

WARING, C. W., Supt. of Wire Prod.
Weaver Wire Prod. Company
2715 North W. 62nd Street
Miami, Florida

WATERS, K. W., Supt. West Mill
Steel Company of Canada, Ltd.
Hamilton, Ont., Canada

WATT, RUSS, Dist. Repr.
General Electric Company
Cleveland, Ohio

WATTS, L. A., Met. Dept.
Wickwire Spencer Steel Division
Colorado Fuel & Iron Corp.
361 Delaware Avenue
Buffalo, N. Y.

WAYMAN, F. G., Asst. Supt. Wire, Nail, Tack Depts.
The Steel Company of Canada, Ltd.
Montreal, PQ., Canada

WEAVER, A. C., Pres.
Weaver Wire Products Company
2715 North W. 62nd Street
Miami, Florida

WEBBER, FRED. A., Plant Met.
Wickwire Spencer Steel Division
Colorado Fuel & Iron Corp.
Buffalo, N. Y.

WEIKEL, G. A., Repr.
American Chemical Paint Company
Ambler, Penna.

WEISE, F. E., Jr.
Bethlehem Steel Company
Williamsport, Penna.

WEYANT, R. K., Supt.
Wilson Steel & Wire Company
4840 South Western Avenue
Chicago, Illinois

WHITMARSH, L. J., Chief Engr.
Mid States Steel & Wire Company
Crawfordsville, Indiana

WICKWIRE, CHESTER F., Treas.
Wickwire Brothers, Inc.
Cortland, N. Y.

WILKE, J. M., Sales Mgr.
Laclede Steel Company
Arcade Building
St. Louis, Missouri

WILKESON, ROBERT C., Sales
Firth Sterling Steel Company
McKeesport, Penna.

WILLIAMS, A. R., Mfg. Die.
The A. R. Williams Machinery Company, Ltd.
64 Front Street, West
Toronto, Ont., Canada

WILLIAMS, J. E.
E. I. DuPont De Nemours & Company
Niagara Falls, N. Y.

WILSON, JOHN A., Vice Pres. & Gen. Mgr.
New England Butt Company
304 Pearl Street
Providence, R. I.

WILSON, JOHN W., Sales
Aluminum Company of America
801 Gulf Building
Pittsburgh 19, Penna.

WOODARD, J. A., Consultant
Federal Wire & Cable Company
Guelph, Ont., Canada

WRIGHT, W. E., Chief Chemist
Connolly's (Blackley), Ltd.
Blackley, Manchester, England

ZAPP, A. R., Carbide Products Mgr.
Firth Sterling Steel Company
McKeesport, Penna.

ZUCKER, LEONARD A., Vice Pres.
The Union Wire Die Corp.
375 Fairfield Avenue
Stamford, Conn.

ZUR, JOHN P., Engr.
The Trauwood Engr. Company
1468 West 9th Street
Cleveland 13, Ohio

New Literature Available On Eutectic "Low Temperature" Welding Rods

A new brochure, "HERE IS INFORMATION ON EUTECTIC", which has just been published by the Eutectic Welding Corporation, New York, contains factual and technical data about EUTECTIC "Low Temperature" WELDING RODS and Fluxes for torch and furnace and "Low Temp Eutec Trodes for arc welding.

* * *

THIS booklet gives specific applications where "Low Temperature" Welding Alloys can be used to good advantage, suggests which welding rod or electrode is best suited for the particular job and lists complete technical information about the welding rod recommended, including bonding and remelting temperatures, Brinell Hardness, Strength, Color Match, etc.

* * *

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THE WIRE ASSOCIATION

RICHARD E. BROWN, Executive Secretary

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Discussion on Present Day Labor Problems

(*Continued from page* 51)

want to call it that, the elimination of difficulties, and both parties can grow.

We, not having the same kind of an industry, aren't confronted with identical problems, but they tend to be similar. We found that in the cafeteria, groups would segregate, so we tried to make each department come over to the table of another department, and in that way mix things up.

Then, we have a staff that serves a grade — that is in direct contact with a grade — and that has grown, and it is surprising how people can be in the business and know so little about the business. We have found that in our plant at least, and I think we are unusual, but I don't doubt you will find the same thing in yours. A question comes up — a customer brings a question in. The correspondent who is to answer that doesn't know. So, we go to the "wailing wall" at ten minutes of one, and the man who has this question asks it and the different departmental heads seek to answer it and enhance everybody's education.

The meeting is a free-will meeting. Nobody has to attend. Certain of us go because we are interested, but it has been in operation now for four months, and every week the attendance increases. Five men are allowed to come from the shop —union people — to listen too, and our differences are dissipated in almost direct relation to the light we shed on the subject. We don't even worry about talking costs in front of these people. We talk costs; we talk competition; we talk abilities; we talk any problems that confronts somebody that is pertinent to the business. All questions are answered at this meeting, and since we make some more than one metallurgical product, we have a debate, and the union men who are free to come take back to their friends some of the difficulties that confront management.

We haven't used that as management-labor committee in any sense of the word. The door is open — the accountants drop in, the grinder handlers will drop in, the dress room men will drop in — and the whole spirit of the plant has tended to become better as a result of shedding light, and acting as though we were on a team struggling for one common purpose.

Chairman Callaghan: Thank you very much.

I am sure some others have the same constructive approach to their individual problem that can be used in whole or in part.

Thank you, Mr. Sanderson, for your very constructive contribution to our program. (Applause).

Discussion on Demineralized Water in the Wire Mill

(*Continued from page* 54)

A member: I mean water treated by this method.

Dr. Morral: If it would have been available then, I would have used it.

A member: Do you have any ideas what impurities you removed in your sulfate bath that produced you beneficial result?

Dr. Morral: I can't tell you off-hand, but I think removal of almost all as good.

A member: Would a concentration of two parts per million, in your opinion, be great enough to cause poisoning of any plating bath?

Dr. Morral: No. The thing is that you control it. You take the water and accept it as such. As I mentioned before, if you don't need two parts per million, you can treat a certain portion and blend it with the other to get the solution you want.

A member: I am highly in favor of getting it down to two parts. I am asking though if that, in your opinion, is good enough to take you out of the danger.

Dr. Morral. I think so. I understand one can do better than that.

A member: In visualizing this in application to continuous production, how long would it take to regenerate a system of that sort? Suppose you have had a big one with probably two or three thousand gallons per hour.

Dr. Morral: I will leave that question to our technical men who handle it. You'd have to consider your water and need, and figure it out. I can't tell you off-hand.

A member: Let's assume your system has been in operation to the point where regeneration becomes necessary. Then how long would that system be without operation in the process of the regeneration of it?

Dr. Morral: I think that with a four-bed unit one could add one line to the continuous mill, and keep a small amount in a reservoir, so when regenerating one could use from the reservoir. Regeneration takes a relatively short time.

A member: How long does it take to regenerate?

Dr. Morral: Ed, do you know? I don't recall any figures on that.

A member: I think the total cycle, or regenerating and washing is of the order of an hour, but it depends on the size of the unit, and the flow which is desired through it, and so on.

Dr. Morral: If you want 100 gallons per hour you may take unit 110 and set it up while you use it to make enough volume. While it is down, you use your reserve water.

A member: I am looking at it not so much as a problem of the wire industry, but we face in rust-proofing materials the use of water that is not too hard in the final rinse. For instance, if you have the combined free acid, you have too much combined alternates in there and you will get into difficulties, so that the use of very soft water is desirable, and in most of those installations they will run them continually, and that means you have to have a continuous overflow of this treated water in this last rinse, and if you had an installation where you were able to divert some of it to storage, you still would be faced with the problem of having so much you wouldn't have storage capacity for it. Therefore, you ought to regenerate in a very, very short time.

Dr. Morral: If you are interested, you should write to our technical men in New York City, and they will be able to answer your problem.

Chairman Callaghan: Are there any further questions?

If not, I will ask one. Has this any application to reducing river polution?

Dr. Morral: Off-hand, I'd say you could use it, but it's rather expensive for that particular purpose. It depends on the water again. If you had plating solutions of valuable metals, you could use a system like this to recover the metals.

A member: That was an interesting question of yours about the reduction of impurities. I had that question in mind.

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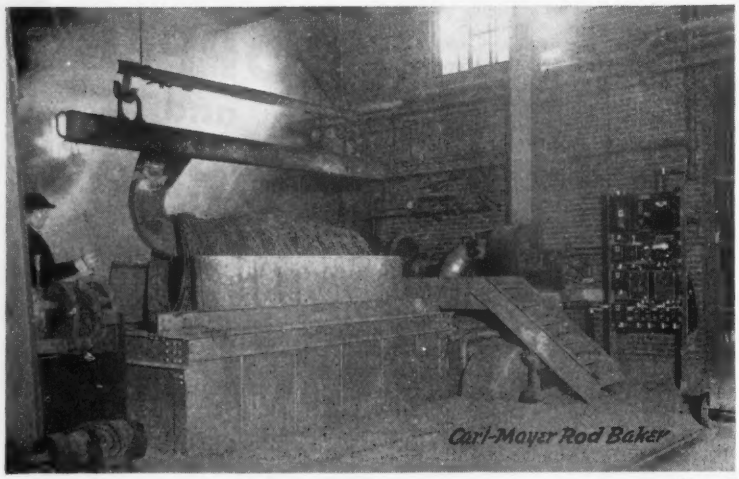

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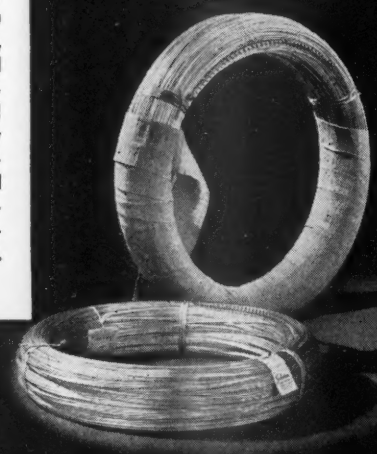

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As a matter of fact, I took it up with another company that had these exchange resins also, and they were quite definite that they had looked into the matter and decided it was impossible to do it. After all, you'd have to regenerate, and when you did you'd put back in as much as you take out.

Dr. Morral: Not necessarily.

A member: But it sounds objectionable when you think of it.

Dr. Morral: The answer is that if resins are cheap and you may make other materials with it, it may be feasible.

A member: Do you have to replace the same kind of ion that you take out? For instance, can you replace a sulphate particle with 002.

Dr. Morral: I don't know. I will have to give that problem some thought. For example, your cycle waste runs about one or two per cent acid, and you could pass it through an anion exchange so as to remove the acid as such and could put it to use.

A member: You still have sulphate of iron besides that.

Dr. Morral: Yes, that's right. The iron would have to be removed in a cation bed and then all the acid in the anion bed.

Chairman Callaghan: If there are no further questions, I will thank Dr. Morral for his very informative and instructive lecture. (Applause).

Written Discussion of the Use of High Frequency Core Losses for Non-Destructive Inspection of Wire Rope

(*Continued from page* 57)

IT may prove desirable in the future to design a lighter, more compact, portable unit, but this is not contemplated at present. Although this particular form of the Cable Tester has been developed for use in mine work, there is no major change necessary for use on elevator ropes. The main difference in these two fields of testing is that elevator ropes carry a much lower unit stress, and the instrument must be set at higher sensitivity to pick out the various differences in magnetic properties. Test coils must, of course, be re-designed for elevator work, since spacing between multiple ropes may be as little as 5/8 inches. The use of swivels on the end of elevator ropes eliminates most of the torsional stress which is sometimes quite evident in mine ropes. A combination of tension and torsional stress will produce enormous effects on magnetic proportion. It has been found in some mine ropes and in the experimental hoist used in this work that the torsional

stresses built up toward the lower end of a rope which is not swiveled produce large variations in magnetic properties in this zone. Fortunately, these stresses are usually of about the same magnitude in repeated tests on the same rope. This factor is, of course, not present to such a degree in elevator ropes.

* * *

THE provision of a satisfactory test method for wire ropes is only one step in increasing the safety of hoisting operations. More obvious steps are to improve the uniformity and quality of wire ropes where possible, and to throw ropes away more often. The only merit of such a non-destructive test method as this is that it detects unusual conditions of corrosion, service fatigue, or overloading, which cannot be foreseen. Supposing that a perfect rope material were used, and all ropes were discarded at about one half their normal life, it would still seem desirable to have such a test method available to make sure that no unforeseen variables were causing the rope to fail.

1. **P. E. Cavanagh, "Stress Comparisons by Correlation with High Frequency Magnetic & Eddy Current Losses", ASM TRANSACTIONS, 1945.**
2. **F. Forster and K. Stambke, (a) "Internal Stresses in Nickel Wire Under Tension", (b) "Internal Stresses in Drawn Nickel Wire", Z. FUR METALLKUNDE, Volume 33, No. 3, March 6, 1941, or RTP Translations Nos. 2098 and 2099, British Ministry of Aircraft Production.**
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4. **P. E. Cavanagh, "A Method for Predicting Failure of Metals", ASTM PROCEEDINGS, 1946.**
5. **A. V. de Forest, "Magnetic Determination of the Elastic State", ASST TRANSACTIONS, Volume 6, page 653 (1924).**
6. **P. E. Cavanagh, "High Frequency Devices for Establishing Identity", METAL PROGRESS, Volume 48, No. 4, October 1945, page 1000.**
7. **R. S. Segsworth, "Examination of Wire Rope with the Cyclograph", Report of General Engineering Co., Ltd., Toronto, Ontario, Canada, January 1946.**
8. **P. E. Cavanagh, "Non Destructive Inspection of Mine Hoist Cable", ASM TRANSACTIONS, 1946.**
9. **Bozorth & Williams, "Effects of Small Stresses on Magnetic Properties", Review of Modern Physics, January 1945, Volume 17, page 72.**
10. **R. Becker, "Internal Strains and Magnetisation", Proceedings of Physical Society, 1940, Volume 52, page 138.**

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IN the wire industry such applications as die lubrication for drawing tungsten, molybdenum and special alloy strand, have constituted important usages of colloidal graphite dispersions.

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Discussion on Mill Practice — The Care and Maintenance of Dies

(*Continued from page 59*)

wonder what it is. Well, what you will find in most cases is you have smeared the cobalt over the carbide before the carbide particles were finished to a smooth surface, and the first pass of your wire left a scratch in the die.

The only thing I can see in dies is a finish which does not smear cobalt. If you use the fine particles of diamond powder in the neighborhood of No. 5 or No. 6 — many of you have seen them in a vial — when you check them up you find they become spheroids very rapidly. You have a lot of little balls, and that fine diamond powder has a tendency to become spherical and they are hard to break down, so that you can, in putting a so-called polish in a die, obtain a washboard finish which is very hard to see with the loop, because the reflected light from that highly-polished surface is such that it doesn't differentiate between a flat surface or corrugated surface. What we'd like to see you get is a flat surface.

That may be obtained with a dull sheen or a bright sheen, depending upon how you do the job, but the thing to do is to get a smooth finish on the die. You can have that with a high polish, or with a dull sheen, and if you look at it even with a naked eye, you wil see tracks which appear to be very fine scratches. Now, that surface in that condition is just as good for resistance to wear and in many cases better resistance to wear than a highly-polished one because you may have some smear.

On putting on the polish in the die, it is not uncommon to take a piece of wood and then take some cotton and put on it and take some powder and go in there and polish it, or some people can take a hardwood stick, drive it into the die, put on an olive oil coating and push it in hard enough to polish it, but then you smear the cobalt; you get enough increase in temperature at the surface to smear the cobalt. So, the thing to guard against is the cobalt smear. I think that is what is handicapping most die people in trying to inspect a die to know whether they have a good surface or don't have a good surface. If you look out for that you will find that you will get rid of all your scratches, and you will have gotten rid of them by not smearing cobalt.

I don't believe you can get a smooth and ultimate surface which will give you best results with a high-mirror finish absolutely free from die scratches because they may be on there an inch deep, but the reflected light will make them appear to be much less. So, if you will just watch it from that standpoint, I think you will arrive at a finish on your die that will be very satisfactory, and as a general practice, it has been my observation that if the work is done with a hard lap and on the so-called semi-automatic polisher, you can get about as ideal a finish on a die without resorting to so-called polishing by burnishing or smearing the cobalt.

Chairman Lewis: Thank you very much, Mr. Longwell. It is always a pleasure and profitable to get the dope right from the horse's mouth. I want to thank Mr. Hussey for bringing up the point — that matter of the mat surface and its ability to pick up and distribute lubrication.

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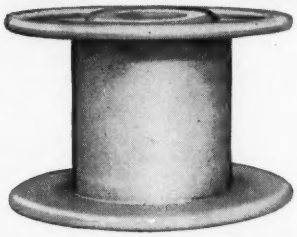

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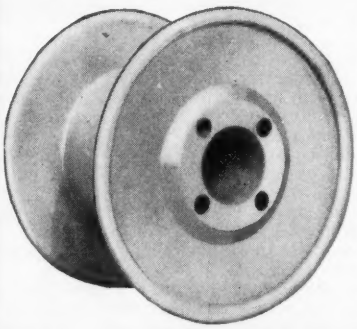

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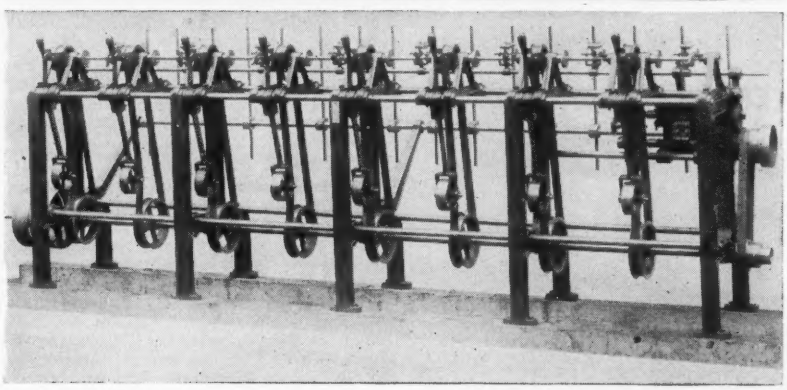

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There has been, in the controversies regarding dies in the foreign press, a point that has been made by several experimenters. They have called attention to the fact that when you first start a rod or a wire through a new, highly-polished die, the first few feet come through very bright and then the wire dulls down to its normal appearance. They point out that this is due to the fact that the highly-polished die does not entrap lubricant, but that a very few feet of wire passing through a mirror-polish die is sufficient to take off the mirror polish and bring you down to the mat that Mr. Hussey spoke of, where the lubricant works its way in between the carbide particles and a normal lubrication takes place.

Does that sound reasonable, Jim?

A member: I think that's right.

Chairman Lewis: In other words, your lubricant is better after you got rid of the high polish?

A member: That's right. I have never advocated a high polish on a die myself. I think you want as smooth and flat a surface as you can get.

Chairman Lewis: In other words, you and I and a lot of other people are in agreement there, but I suppose the argument will go on.

A member: We redraw a good deal of wire for cold heading products and maintain for that purpose one set of dies and die sizes. What do you think of the practice of drawing brass and aluminum and bronze with the same dies, without changing the shapes or angles?

Mr. Preston: Well, you're drawing low carbon.

A member: It's based on low-carbon steel.

Mr. Preston: I think you are perfectly all right.

A member: You don't need to change?

Mr. Preston: I don't think it is necessary.

Chairman Lewis: Isn't it safe to say, Mr. Preston, that the die angle depends on the percentage reduction you are going to make rather than the metal you are handling?

Mr. Preston: I think so.

Chairman Lewis: This could go on, I am quite sure — if any one has any pressing questions, will he put them now, because I have been notified we have got to get out of here by half past twelve on account of the scheduling of the luncheon.

In that case, if there are no immediate questions, I am going to call on Mr. Anderson of the National Lock Company to present his views on the preparation of metallographic specimens. Mr. Anderson!

Discussion on Aluminum Wire Fabrication

(*Continued from page* 62)

We have experimented with various types of lubricants and we are using petroleum base lubricants today of such a type that we do not encounter any excessive die wear. In some cases we have encountered difficulty from die scratching with very high strength alloys or wire that had been heat-treated before drawing and in those cases we have found other lubricants. The use of powdered soap is an advantage in preventing die scratching or excessive die wear, but in general I would say that these difficulties are not a problem.

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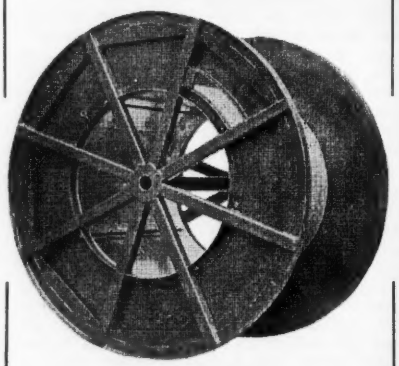

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A member: The reason I ask is that we have been drawing a small amount, using dry soap, and we find we get excessive die wear on the first draft, after that, why no trouble at all. The first draft is where we get trouble, and we also have experienced that in some wet drawing.

Mr. King: In that connection, I might state that we have never found a water base lubricant to be satisfactory for wire drawing at Massena. In this case we have found excessive die wear in the first die and therefore we would recommend that you use an oil base lubricant similar to those mentioned by Mr. Spaulding in his paper.

I am surprised you had difficulty with soap. What alloy was that you were working on?

A member: 56-S.

Mr. King: Three-eighths rod?

A member: No. Quarter-inch.

Mr. King: That isn't rolled rod, is it?

A member: No. That had previously been drawn from 3/8 to 1/4 inch.

Mr. King: Well, I am surprised that you had any trouble. Your difficulty may be in your die contour. That might possibly be the reason.

A member: It's only the first die. After that it is all right.

Mr. King: What type of soap did you use? Regular wire-drawing?

A member: No. A straight high-grade tallow soap.

Mr. King: Well, I am surprised that you had that difficulty. We haven't experienced it.

In what sort of a machine are you doing that?

A member: That's a cone-block machine.

Mr. King: You can't use a light grease in that operation? Have you tried heavy grease?

A member: What grease could be used?

Mr. King: You can't use a circulating lubricant.

A member: No.

Mr. King: You might try a heavy grease like Socony Vacuum CN medium, or some hard grease that will roll in the die. I am surprised though that you had trouble with soap.

A member: I have been told too that we might dip the coils in oil. The trouble is that once we establish it on the wire the trouble is over, but it is the first die that is the trouble.

Mr. King: It is rather difficult to analyze your problem without knowing more about it, such as seeing the wire, the die, the machine, etc., but possibly it might be connected with the angle at which the wire enters the die. Sometimes that causes trouble. If the wire enters the die at an angle, it rubs on the bell mouth of the die.

I don't believe I can give you any more help on that without knowing more about the problem.

Chairman Fowles: Are there any more questions?

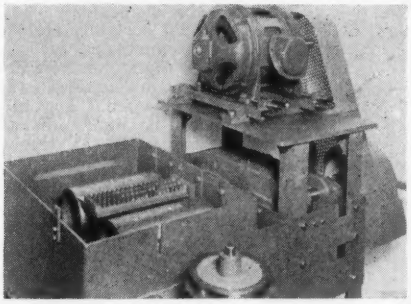
A member: Is this viscosity of the lubricant critical in relation to the die-wear?

Mr. King: Well, in general we like to use a heavy lubricant for the larger sizes wherever looping is not a problem. I think you get higher film strength that way and less difficulty from die-wear, and ringing of the dies. But in the smaller sizes it is necessary to go to a lower viscosity in order to prevent looping.

Chairman Fowles: Are there any further questions?

A member: If you were building a new continuous machine for ACSR wire, would

CONTINUOUS WIRE DRAWING MACHINE



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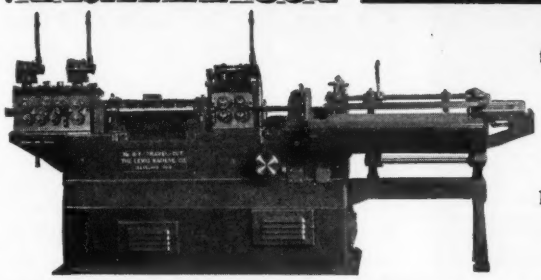

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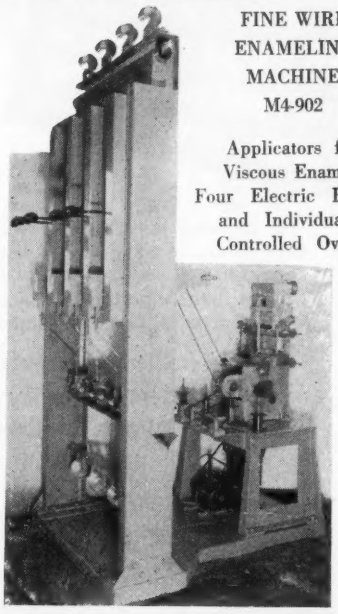

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you go to thirty per cent reductions throughout, or would you taper those reductions, or would you go further than that if you had the chance?

Mr. King: Well, I'd certainly start out with at least 30% reductions.

In general, we do taper them off down to around 20%, in the smaller sizes. I think that is the best practice, but I wouldn't say that it couldn't be done otherwise. You might stick to 30% all the way through if you were working with a very ductile material like electrical conductor wire.

A member: Then your practice is not to use thirty per cent straight through all the way?

Mr. King No, we don't. We taper off.

Chairman Fowles: Are there any further questions?

If not, I am sure we all want to express our appreciation to Mr. King for presenting the paper, and for his excellent answers to those questions. (Applause).

* * *

New Data Sheet Issued by American Chemical Paint Co.

A new technical service data sheet. No. 5-2, covering Flosol Soldering Fluxes has been made available to interested persons by the **American Chemical Paint Company**, Ambler, Pa.

* * *

THESE fluxes will wet oily surfaces and clean and flux them. It is manufactured in five types, each of which is described in the data sheet, which gives their characteristics, uses, advantages and applications. Copies may be had upon request.

* * *

Durant Opens Offices in Chicago and Milwaukee

THE **Durant Manufacturing Company**, Milwaukee 1, Wisconsin, manufacturers of Productimeter Counting and Measuring devices for industrial use, announces the opening this fall of their Chicago and Milwaukee Sales Offices.

* * *

THE Chicago Office, 224 South Michigan Boulevard, is under the management of **Orville E. Paramore**; and the Milwaukee Sales Office, at the Company address, is directed by **E. W. Crane**, who has been with the Durant organization for over 12 years.

* * *

BOTH Mr. Paramore and Mr. Crane have a background of many years' experience in the industrial counting field, and are particularly well qualified to render complete service on counting and measuring problems in their respective territories.

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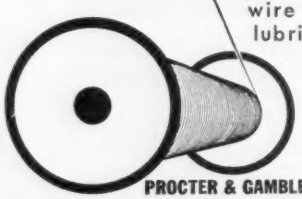

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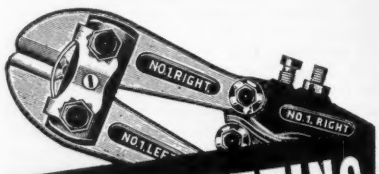

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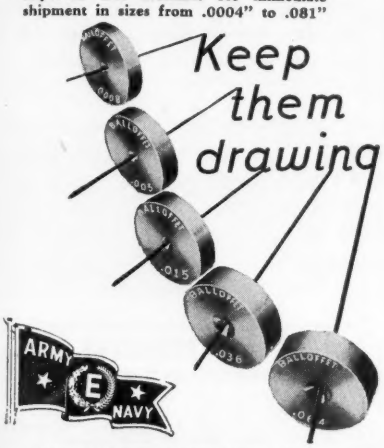

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New Diamond Die and Tool Catalog

THE **Champion Diamond Company**, 531 Fifth Avenue, New York City, has issued a new folder, the Champion Diamond Catalog, describing their line of diamond dies and tools, which includes some new items. Copies may be had by writing to the company direct.

* * *

Diamond Dies Removed from Inventory Control

SWEEPING revisions of the inventory control regulation (Priorities Regulation 32), announced today by the Civilian Production Administration removed 40 products from all inventory control and modified the restrictions on 18 other items. Among the items removed from control are diamond dies.

* * *

Canadian Wire Firm to Close Down

A notice sent to suppliers and customers of the **Northern Bolt, Screw and Wire Company** of Owen Sound, Canada, advises that they are forced to bring their business to a conclusion by increased costs, with which allowable selling prices have not kept pace.

* * *

WAGES in their plant increased over 70% and their supplies increased anywhere from 5% to 100%, so that caught in the squeeze and being forced to hold prices at the same level as those at which they billed in 1938, they can no longer stand the losses forced upon them.

* * *

THEY will, however, continue to operate until their present stock of raw materials are used up.

* * *

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Buys Spooling Machine Business

ANNOUNCEMENT was made in December of the purchase of the complete Spooling Machine business from the **Fidelity Machine Company** by the **Charles P. Boyd Corporation**, 200 North 21st Street, Philadelphia 3, Pa.

* * *

THE Fidelity Machine Company will carry on the manufacture of wire covering equipment as before, and **Robert M. Harbeck**, Sales Engineer, who represents Fidelity in the wire industry, will continue to represent both the Fidelity Machine Company and the Charles P. Boyd Corporation, so that there will be no change so far as the customers of both types of machines are concerned.

Franz Made Vice President in Charge of Operations of C. F. & I.

CARL W. Meyers, President of the **Colorado Fuel and Iron Corporation**, has announced the election of **A. F. Franz** of Pueblo, Colorado, as Vice President in charge of operations. He will succeed Robert T. Dunlap of Buffalo, New York, who has resigned.

* * *

MR. Franz is a native of Cleveland, Ohio. Before coming to the Wickwire Spencer Steel Division of the Corporation at Buffalo, New York, as General Superintendent of the Buffalo Plant, he was associated with the Allan Wood Steel Company of Conshohocken, Pa. Mr. Franz was appointed works manager of the Colorado division last March. In this new position he will have complete charge of all operations of the Corporation.

Western Electric Man to Head American Standards Association

FREDERICK R. Lack, vice president of **Western Electric Company** will be president of the American Standards Association for the ensuing year, it was announced at the concluding session of the annual meeting in November.

* * *

MR. Lack, who was formerly vice-president, succeeds Henry B. Bryans, executive vice president of the Philadelphia Electric Company.

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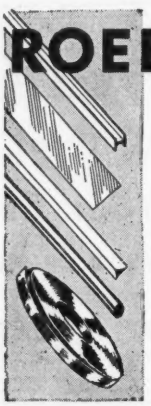

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New Metal Cleaning Compositions

SOAP is specified as the detergent in the cleaning compositions described by **G. W. Gregg** in U. S. Patent 2,386,789. Although not limited to metals, these compositions are primarily designed to remove oil, grease, carbon, gums, gasoline stains, and foreign matter generally from metals and metal parts. The cleaners require no special equipment and have no injurious effects on the metal or metal parts, including those which have been subjected to dichromic or anodic treatment (e. g. zinc die castings and aluminum castings). The compositions, which may be employed as surface cleaners or immersion baths, may be used cold. They are highly stable and non-corrosive and have a sufficiently high flash point to be safe in use without special precautions or special apparatus. The base formula for such cleaners, which also indicates the function of each ingredient, is given as follows:

Solvent (2/3 ethylene dichloride, 1/3 propylene dichloride)	20.0	per cent
Soap (vegetable oil soap)	10.0	„ „
Penetrant (tar acid oil containing not less than 5% tar acid)	33.0	„ „
Coupling agent (butyl alcohol)	8.0	„ „
Antifoaming agent (denatured alcohol)	6.0	„ „
Preservative (finely powdered rosin)	1.0	„ „
Blending and thinning agent (sodium bichromate)	2.0	„ „
Water (sufficient to dissolve the soap)	20.0	„ „

* * *

IT is explained that soap is used for its detergent action, a vegetable soap being preferred because it dissolves more readily in cold water. The soap tends to surround the particles of foreign matter and contamination and to break down the surface tension of such materials. The solvent present breaks the bond between the foreign matter and the metal, and the soap tends to surround the particles after the bond is broken. When thus broken away and surrounded with soap, the foreign matter settles to the bottom of the bath as a sludge. hence no scum is formed.

* * *

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Phosphor Bronze	
Picture Wire	

THE MALIN & CO.
2514 Vestry Ave., Cleveland 13, Ohio

Synthetics for Wire and Cable

(*Continued from page 45*)

heat at this temperature. Although classed as a thermoplastic, it probably requires more heat and pressure to form than could be withstood by vulcanized insulations. Extrusion has been accomplished but very slowly, at high pressure and at temperatures usually associated with metals. It does not burn. We have made cables commercially with Teflon applied by tapes, and the resulting cable shows no signs of deterioration after 1½ years in air at 125°C. The tapes were manufactured by cutting the material like a veneer is cut from the log of wood.

* * *

NYLON is another material finding use as an extruded plastic cover. It is somewhat flexible when applied in a thin layer and is extremely tough. You may have seen some of the drinking glasses made from it which resist all kinds of abuse without breaking. Although classed as self-extinguishing when burned, it will not always prevent an inflammable insulation from burning unless the thickness proportions are in its favor. As a sheath over polyethylene, it gives some flame and cutting resistance.

* * *

IN summary, the age of natural rubber insulation alone is developing into an age where particular operating conditions will almost always dictate a particular synthetic either as insulation or sheath or both. The synthetics are replacing rubber in many places and at the same time extending its use so that if the price of natural rubber gets competitive with **CR-S**, its prewar use may be greatly increased. We are learning by test and by service more uses and limitations of synthetics all the time, and it all makes for more work. There is such a wide selection of raw materials (when they can be obtained) that decisions based on experience and judgment are keeping many engineers busy. Shortages of vital materials such as lead (the unique outer covering in its flexibility and impermeability to water) are causing tests and trials of all kinds of materials. Some are going to work well enough to more than just "get by".

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FINE WIRE SPOOLING HEADS
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THE WIRE IS
in every respect usable.

PRICE 30c PER LB.
if entire lot is taken by
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WIRE AND WIRE PRODUCTS

A Review of Recent Wire Patents

(*Continued from page 75*)

Calif., assignor to Shell Development Company, San Francisco, Calif., a corporation of Delaware.

The composition comprises corrosion-preventive composition comprising a predominant amount of a hydrocarbon fraction containing finely dispersed a corrosion retardant amount of an organic monobasic acid of between about 10 and about 60 carbon atoms and containing a radical selected from the group consisting of nitrile, nitro and nitroso radicals which is not more than four carbon atoms removed from the acid radical.

* * *

No. 2,411,674, ART OF ELECTRODEPOSITION OF COPPER, patented November 26, 1946 by Ernest D. Wilson, Worcester, Mass., assignor to Arthur D. Little, Inc., Cambridge, Mass., a corporation of Massachusetts.

There are 32 claims to this patent for depositing a bright, smooth, firmly-adherent deposit from an undivided cell containing an aqueous electrolyte of a soluble copper salt (as copper sulphate) and an alkylene polyamine (as ethylene diamine) to form a complex with the salt, as well as a hydroxy acid such as lactic, citric and tartaric acids, or their alkali metal salts.

* * *

Did You Know That

THE Signal Corps has devised a one-man public-address system —a voice amplifier worn slung around the neck? It is powered by a storage battery (rather than a dry cell) and weighs less than three pounds.

* * *

Aluminum Electrical Wire

WITH copper still in short supply, one electrical manufacturing company has turned to aluminum as a substitute in its building wire and cable division. The company points out that aluminum has high electrical conductivity and "will remove one of the obstacles to building construction."

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Wire and cable products manufacturer has opening for general supervisor to assume full charge of manufacturing on night shift. Supervisory experience and knowledge of electrical wire and cable manufacturing essential. Attractive salary, yearly bonus, merit increases. Insurance benefits. Excellent opportunity with established firm in Metropolitan New York area. State fully age, experience, qualifications.

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WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Directory, Index & Buyers' Guide.

ABRASIVES—
Norton Co., Worcester, Mass.

ACID INHIBITORS—
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

ACID-PROOF CONSTRUCTION—
Ceilcote Co., The, Cleveland, Ohio.
Sauereisen Cements Co., Pittsburgh, Pa.

AIR DRAW FURNACES
Carl-Mayer Corp., Cleveland, Ohio.

ALKALINE CLEANERS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.

ANNEALING MACHINES—Open Flame
Syncro Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J

ARMORING EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O. Engr. Corp., N. Y., N. Y.

BENDERS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

BOBBINS—Braider & Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

BORON CARBIDE
Norton Co., Worcester, Mass.

BRAKES—Pneumatic
Entwistle, Jas. L. Co., Pawtucket, R. I.

BRAKES & SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

BRICKS—Acid Proof
Keagler Brick Co., Steubenville, Ohio.

CABLE LACQUERING OVENS
Industrial Ovens, Inc., Cleveland, O.

CABLE REEL BORERS—
Rott, B. M. Co., York, Pa.

CABLE—Steel and Copper
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.

CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N.J.

CEMENTS—Acid Proof
Sauereisen Cements Co., Pittsburgh, Pa.
Ceilcote Co., The, Cleveland, Ohio.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANERS—Hand and Metal
American Chemical Paint Co., Ambler, Pa.
Magnus Chemical Co., Garwood, N. J.
Apex Alkali Products Co., Phila, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIP.—
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

CLOTH TESTERS—
Scott Testers, Inc., Providence, R. I.

CLOTH—WIRE. All Metals
Reynolds Wire Co., Dixon, Ill.
Roebling's John A. Sons, Co., Trenton, N. J

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

COILERS—Sheet, Strip and Wire
Entwistle, Jas. L. Co., Pawtucket, R. I
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J. Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

COLD HEADERS—
Ajax Manufacturing Co., Cleveland, Ohio
National Machinery Co., Tiffin, Ohio
Waterbury-Farrel Foundry & Machinery Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa
Apex Alkali Products Co., Philadelphia, Pa

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Phila., Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds, Co., Chicago, Ill.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O

CUTTING TOOLS—Carbide
Carboloy Co., Inc., Detroit, Mich
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Michigan Wire Die Co., Detroit, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Union Wire Die Corp., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND TOOLS—
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Michigan Wire Die Co., Detroit, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Union Wire Die Corp., New York, N. Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Lead Extrusion
Robertson, John, Co., Brooklyn, N. Y
Wayne Wire Die Co., Hillside, N. J.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies Co., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Michigan Wire Die Co., Detroit, Mich.
New Eng. Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Union Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Rod and Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Firth Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Michigan Wire Die Works, Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Tungsten Alloy Mfg. Co., Newark, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIRECT ELECTRIC RESISTANCE HEATING —
Tranwood Engr. Co., Cleveland, Ohio

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass

DRYING & PRE-HEATING ROOMS—
Carl-Mayer Corp., Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.

DRYING EQUIPMENT—
Carl-Mayer Corp., The, Cleveland, Ohio.
Ross, J. O. Engr. Corp., N. Y., N. Y.

ENGINEERS—Consulting Wire Mill
Lewis, Kenneth B., Worcester, Mass
Syer, C. Raymond, Westport, Conn.

EQUIPMENT—Insulation Testing
Entwistle, James L., Co., Pawtucket, R. I

EYELETS—Brass or Zinc
Platt Bros., & Co., The, Waterbury, Conn.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M. Co., Pittsburgh, Pa.

FRICTION PAY-OFF STANDS—
Industrial Ovens, Inc., Cleveland, Ohio.

FURNACES—Annealing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engrs. Inc., Pittsburgh, Pa.
Hayes, C. I. Co., Providence, R. I.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

WHERE TO BUY, Continued

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.
Firth-Sterling Steel Co., McKeesport, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Hayes, C. I. Co., Providence, R. I.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Galvanizing Equipment
Ajax Electric Co., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Hard'ing & Temp'ing
Ajax Electric Co., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Tranwood Engr. Co., Cleveland, Ohio

FURNACES—Lead Melting
Electric Furnace Co., Salem Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Ajax Electric Co., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Ajax Electric Co., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.

FURNACES— POT (Oil, Gas, Electric)
Ajax Electric Co., Philadelphia, Pa.

FURNACES—Salth Bath
Ajax Electric Co., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corporation, Toledo, O.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corporation, Toledo, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GOVERNMENT SURPLUS MATERIALS
War Assets Corporation, New York, N Y.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of Cleveland.
Crane & Engineering Co., Wickliffe, Ohio.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M. Co., Pittsburgh, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
Industrial Ovens, Inc., Cleveland, Ohio.

INSULATING MATERIALS—
Crepe-Kraft Co., Newark, N. J
Du Pont de Nemours, E. I. Co., Wilmington, Del.
Standard Varnish Wks., Staten Island, N. Y.

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Morgan Construction Co., Worcester, Mass.
Roos, H. & G., Tool & Mfg. Co., Montclair, N.J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

LININGS—Acid and Alkali Proof
Ceilcote Co., The, Cleveland, Ohio.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Apex Alkali Products Co., Phila., Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Mach'y, Inc., Pawtucket, R. I

MACHINERY—Brazing
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bolts & Rivets
National Machinery Co., Tiffin, Ohio

MACHINERY—Bunching
American Insulating Mach'y Co., Phila, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester. Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester. Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable Reel Boring
Rott. B. M. Co., York, Pa.

MACHINERY—Chain Making
Nilson, A. H. Machine Co., The, Bridgeport, Conn.

MACHINERY—Cable, Rope Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Entwistle, Jas. L. Co., Pawtucket, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Coilers
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J. Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Cold Heading
Ajax Manufacturing Co., Cleveland, Ohio
National Machinery Co., Tiffin, Ohio

MACHINERY—Copper Wire Drawing and Rolling
American Insulating Mach'y Co., Phila, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila, Pa.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cutting
Ajax Manufacturing Co., Cleveland, Ohio
Eisler Engineering Co., Newark, N. J.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, Ohio.
Moslo Machinery Inc., Cleveland, Ohio.
National Mach'y Exch., (Used), New York, N Y
Nilson, A. H. Machine Co., Bridgeport, Conn
Porter, H. K. Inc., Everett, Mass.
Shuster, F. B. Mfg., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Die Making
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Roos, H. & G., Tool & Mfg. Co. Montclair, N
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Ajax Manufacturing Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Edging
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, O.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Extruding
Robertson John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Fence
Glader, Wm. Machine Works, Chicago, Ill.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Forming
Eisler Engineering Co., Newark, N. J.
National Mach'y Exch. (Used), New York, N.
Nilson, A. H. Machine Co., Bridgeport, Conn
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Seifert, E. R., Inc., Syracuse, N. Y.
Sleeper & Hartley, Inc, Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Pawtucket, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co, Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, e
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail, Div. of the Cleveland.
Crane & Engineering Co., Wickliffe, O.

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Pawtucket, R. I.

WHERE TO BUY, Continued

England Butt Co., Providence, R. I.
cro Machine Co., Perth Amboy, N. J.
son Machine Co., Paterson, N. J.

CHINERY—Nail and Tack
der, Wm. Machine Works, Chicago, Ill.
ional Mach'y Exch. (Used), New York, N.Y.
per & Hartley, Inc., Worcester, Mass.
n Equipment Corp., Cleveland, Ohio.

CHINERY—Panning
erican Insulating Mach'y Co., Phila., Pa.
cro Machine Co., Perth Amboy, N. J.

CHINERY—Pointing
gan Construction Co., Worcester, Mass.
sch, H. J., Machine Co., Newark, N. J.
dder, E. J., Fdry. & Mach., Co., Trenton, N.J.
per & Hartley, Inc., Worcester, Mass.
erior Tool & Mfg. Co., Worcester, Mass.
cro Machine Co., Perth Amboy, N. J.
rington Mfg. Co., Torrington, Conn.
ghn Machinery Co., Cuyahoga Falls, O.
terbury-Farrel Foundry & Machinery Co.,
Waterbury, Conn.
n Equipment Corp., Cleveland, Ohio.

CHINERY—Rod Mill
gan Construction Co., Worcester, Mass.
sch, H. J., Machine Co., Newark, N. J.
Equipment Corp., Cleveland, Ohio.

CHINERY—Rolling Mill
an Construction Co., Worcester, Mass.
ional Mach'y Exch. (Used), New York, N.Y.
ch, H. J., Machine Co., Newark, N. J.
cro Machine Co., Perth Amboy, N. J.
rington Mfg. Co., Torrington, Conn.
terbury-Farrel Foundry & Machinery Co.,
Waterbury, Conn.
n Equipment Corp., Cleveland, Ohio.

CHINERY—Rubber for Insulating Wire
le, John & Sons, Paterson, N. J.

CHINERY—Rubber Tubing and Training
England Butt Co., Providence, R. I.
le, John & Sons, Paterson, N. J.
per & Hartley, Inc., Worcester, Mass.
rington Mfg. Co., Torrington, Conn.

CHINERY—Screw Wire
ional Mach'y Exch. (Used), New York, N. Y.
per & Hartley, Inc, Worcester, Mass.

CHINERY—Special
erican Insulating Mach'y Co., Phila, Pa.
ory, Robert J., Co., Newark, N. J.
twistle, Jas. L. Co., Pawtucket, R. I.
w England Butt Co., Providence, R. I.
esch, H. J., Machine Co., Newark, N. J
dder, E. J., Fdry. & Mach., Co., Trenton, N.J.
per & Hartley, Inc., Worcester, Mass.
perior Tool & Mfg. Co., Worcester, Mass.
cro Machine Co., Perth Amboy, N. J.
rington Mfg. Co., Torrington, Conn.
tson Machine Co., Paterson, N. J.
an Equipment Corp., Cleveland, Ohio.

CHINERY—Spooling
erican Insulating Mach'y Co., Phila., Pa.
yd, Charles P., Corp., Philadelphia, Pa.
ler Engineering Co., Newark, N. J.
ory, Robert J., Co., Newark, N. J.
twistle, Jas. L. Co., Pawtucket, R. I.
w England Butt Co., Providence, R. I.
per & Hartley, Inc., Worcester, Mass.
cro Machine Co., Perth Amboy, N. J.
rington Mfg. Co., Torrington, Conn.
ghn Machinery Co., Cuyahoga Falls, O.
terbury-Farrel Foundry & Machinery Co.,
Waterbury, Conn.
tson Machine Co., Paterson, N. J.
re & Textile Mach'y, Inc., Pawtucket, R. I.

CHINERY—Spring Making
tional Mach'y Exch. (Used), New York, N. Y.
per & Hartley, Inc., Worcester, Mass.
rington Mfg. Co., Torrington, Conn.

CHINERY—Staple
per & Hartley, Inc., Worcester, Mass.

CHINERY—Straightening
x Manufacturing Co., Cleveland, Ohio
allden Machine Co., Thomaston, Conn.
wis Machine Co., The, Cleveland, Ohio.
slo Machinery Co., Cleveland, Ohio.
tional Mach'y Exch. (Used), New York, N. Y.
laon, A. H. Machine Co., Bridgeport, Conn.
esch, H. J., Machine Co., Newark, N. J
uster, F. B., Mfg. Co., New Haven, Conn.
per & Hartley, Inc., Worcester, Mass.
rington Mfg. Co., Torrington, Conn.
an Equipment Corp., Cleveland, Ohio.

MACHINERY—Stranding
Huhgesville Machine & Tool Co., Hughesville, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Swaging
National Mach'y Exch. (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Fdry. & Mach. Co.,
Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing Equipment—Sparkers
Entwistle, Jas. L., Pawtucket, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Welding Wire
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wind-up (Constant Tension, Variable Speed)
Industrial Ovens, Inc., Cleveland, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
Ajax Manufacturing Co., Cleveland, Ohio
American Insulating Mach'y Co., Phila, Pa.
Eisler Engineering Co., Newark, N. J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach., Co., Trenton, N.J.
Sleeper & Hartley, Inc, Worcester, Mass.
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co.,
Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Wood Screw
National Mach'y Exch. (Used), New York, N. Y.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Torrington Mfg. Co., Torrington, Conn.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Procter & Gamble, Cincinnati, Ohio
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Dehydrogenizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O. Engr. Corp., N. Y., N. Y.

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAINTS—Marine
American Chemical Paint Co., Ambler, Pa.

PAINTS—Structural Steel
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER—For Coil Wrapping and Corrosion Prevention
Crepe-Kraft Co., Newark, N. J.

PAPER TESTERS—
Scott Testers, Inc., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D.C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

PICKLING TANK LININGS—
Ceilcote Co., The, Cleveland, Ohio.
Sauereisen Cements Co., Pittsburgh, Pa.

PIPES & FITTINGS—Acid Resistant
Ceilcote, Co., The, Cleveland, Ohio.

PLASTIC TESTERS—
Scott Testers, Inc., Providence, R. I.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio.

POTS—Lead Melting
National Annealing Box Co, Washington, Pa.
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co., Phila, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach., Co., Trenton, N.J
Sleeper & Hartley, Inc, Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

REELS—Annealing and Stranding
Howsam Spool Co., Aurora, Ill.

REEL AND TENSION STAND—
Industrial Ovens, Inc., Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.
Sleeper & Hartley, Inc, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.

WHERE TO BUY, Continued

Hayward, R. B. Co., Chicago, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Collapsible
Entwistle, Jas. L. Co., Pawtucket, R. I.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Bridge Manufacturing Co., Hazardville, Conn.
Hayward R. B. Co., Chicago, Ill.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Hayward R. B. Co., Chicago, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Stevens Metal Products Co., Niles, Ohio.

REELS—Vulcanizing & Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hayward R. B. Co., Chicago, Ill.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hayward R. B. Co., Chicago, Ill.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Wooden
Bridge Mfg. Co., Hazarville, Conn.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.

RODS—Wire—Non-Ferrous
American Brass Co., Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

ROLL STRAIGHTENERS—
Moslo Machinery Co., Cleveland, Ohio.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott Testers, Inc., Providence, R. I.

RUST PROOF COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

SATURATION SYSTEMS
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Potter, Neil C., Newark, N. J.
Procter & Gamble, Cincinnati, Ohio
Standard Industrial Compounds Co., Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Ovens, Inc., Cleveland, Ohio.

SPOOLING—Wire
Jersey Specialty Co., Little Falls, N. J.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hayward R. B. Co., Chicago, Ill.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill
Mossberg Pressed Steel Corp., Attleboro, Mass
Stevens Metal Products Co., Niles, Ohio.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPRINGS—Tools for Forming
State Machine Tool Co., Hartford, Conn.

STAMPINGS—Steel
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg., Co., Tostoria, Ohio
Youngstown Sheet & Tube Co., Youngstown, O.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., Paterson, N. J.

TANK LININGS—Brick
Ceilcote Co., The, Cleveland, Ohio.
Keagler Brick Co., Steubenville, Ohio.

TANK—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Ceilcote Co., The, Cleveland, Ohio.
Sanereisen Cements Co., Pittsburgh, Pa.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.
National Annealing Box Co., Washington, Penna.

TOOLS—Spring Forming
State Machine Tool Co., Hartford, Conn.

TOOLS—Wire Cutting
Porter H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRAVERSES—For Reels
Entwistle, James L. Co., Pawtucket, R. I.
Hubbard Spool Company, Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio.

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

TREADS—Safety
Norton Co, Worcester, Mass.

TUBE BENDERS AND FORMERS—
Ruesch, H. J. Machine Co., Newark, N. J.

VARNISHES—For Insulation
Standard Varnish Wks., Staten Island, N. Y.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.

WIND-UP AND UNWIND SYSTEMS—Continuous
American Insulating Mach'y Co., Phila, Pa.
Entwistle, James L. Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, O.
Watson Machine Co., Paterson, N. J.

WIRE—Aluminum
Aluminum Co. of America, Pittsburgh, Pa.
Malin & Co., Cleveland, Ohio.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O

WIRE—Electric
American Brass Co., Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Enameled for Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Reynolds Wire Co., Dixon, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Youngstown Sheet & Tube Co., Youngstown, O

WIRE—Music
American Brass Co., Waterbury, Conn.
Johnson Steel & Wire Co., Inc., Worcester, Mass
Malin & Co., Cleveland, Ohio.

WIRE—Nickel Silver and Phosphor Bronze
American Brass Co., Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Non-Ferrous to Specification for Special Purposes
American Brass Co., Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Winsted Div. of Hudson Wire Co., Winsted Conn

WIRE—Spring
American Brass Co., Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Firth-Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Youngstown Sheet & Tube Co., Youngstown, O

WIRE—Stainless Steel
Firth-Sterling Steel Co., McKeesport, Pa.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Youngstown Sheet & Tube Co., Youngstown, O

WIRE—Zinc
Platt Bros & Co., The, Waterbury, Conn.

WIRE CLOTH—Industrial
Roebling's John A., Sons Co., Trenton, N. J.
Reynolds Wire Co., Dixon, Ill.

WIRE TESTERS—
Scott Testers, Inc., Providence, R. I.

WIRE SPOOLING—
Jersey Specialty Co., Little Falls, N. J.

WIRE, WEAVING—Non-Ferrous
American Brass Co., Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Reynolds Wire Co., Dixon, Ill.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.

YARNS & TAPES—
Du Pont de Nemours E. I. Co., Wilmington, Del

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY
ESTABLISHED 1845
PATERSON 3, NEW JERSEY, U. S. A.

Wire & Wire Products
January, 1947.

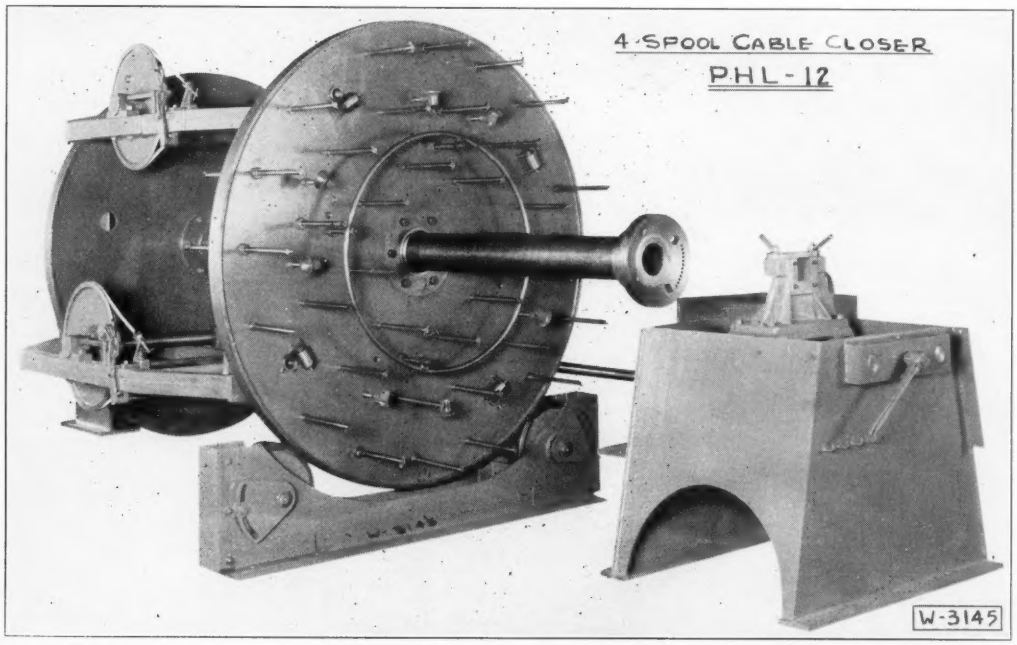
ELECTRICAL WIRE AND CABLE AND WIRE ROPE MACHINERY

CABLE CLOSERS — TYPE "PH-L"

For CABLING where high speeds are not required, we offer this **ALL STEEL** and **FULLY ANTI-FRICTION BEARING DESIGN** at a **considerable cost advantage.**

These heads are available in **five sizes,** both in "four" and "six" Spool Designs.

All but Reverse and Speed Change Gears are located in the HEAD CASING. Reverse and Speed Change Gears operate in an easily accessible housing. **All gearing is force-feed lubricated.**



BRAKES are "SPRING-SET AIR-OFF" and **fully automatic.**

INTERSTICE FILLER COPS are carried on spindles in the EXIT SPIDER.

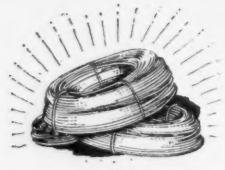
Please note that with Speed Change Gears, these heads possess Lay Range and Motor advantages in direct proportion to the speed change.

Literature is available on these heads, as well as on High-Speed Concentric Tapers, Capstans, Takeups and Traverse, and Let-Offs, usually furnished with such Closers.

The submission of Proposals will be facilitated if Closer Spool and Takeup Reel dimensions and characteristics of available electric current are included in the inquiry.

EF Furnaces

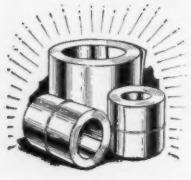
For Bright Annealing Wire, Strip, Tubing, etc.



The Above Combination Gas-Electric Furnace

With Heavy V-type Cast Grid Heating Elements
and EF Gas-Fired Recuperative Type Radiant Tubes

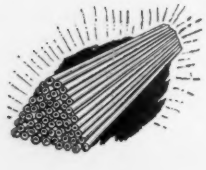
Bright Anneals 2500 lbs of Copper Wire Per Hour



Bright, uniformly annealed copper wire — at the rate of 1¼ tons per hour — is discharged continuously from the above combination gas-electric, controlled atmosphere furnace. This furnace handles rod in coils up to 36" in diameter as well as wire on large reels. The material is carried through the furnace on bulkhead type trays which provide an effective seal for the protective atmosphere used in the equipment. These trays eliminate the use of doors, lock chambers, or other sealing devices at either the charging or discharging ends of the furnace.

The heating chamber is divided into two separately and automatically controlled zones, the first or charging zone is heated by EF gas-fired recuperative type radiant tubes. The second or soaking zone is heated by heavy V-type cast alloy heating elements. The heating elements in each zone are located above and below the charge and extend the entire width of the chambers, insuring absolute temperature uniformity throughout the charge.

The protective atmosphere is produced in an EF generator located beside the furnace.



Other oustanding EF production furnace installations include furnace for bright annealing, both ferrous and non-ferrous strip, wire, tubing and other products... furnaces for the production heat treatment of bolts, springs, castings, stampings and forgings; as well as furnaces for aluminum, copper and brass brazing; billet heating, scale-free hardening and other processes.

Submit your furnace problems to EF engineers... we specialize on building production furnaces.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production